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CASS SMITH (W. P.). **Vegetable seed treatments.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 3, pp. 210–216, 2 figs., 1943.

Short, practical directions are given in tabular form for the treatment of vegetable seed against common diseases, together with notes on the preparation and use of different fungicides.

STILLE (B.). **Der mikrobielle Verderb getrockneter Lebensmittel in Abhängigkeit von der relativen Luftfeuchtigkeit.** [The microbial spoilage of dried foodstuffs as conditioned by the relative atmospheric humidity.]—*VorrPfl Lebensm-Forsch.*, v, pp. 403–408, 1942. [Abs. in *Chem. Zbl.*, cxiv (ii), 10, p. 967, 1943.]

At the Naval Food Preservation Experiment and Research Station, Hanover, *Aspergillus glaucus* was shown to be extremely xerophile, being the last of the organisms tested to cease growth with declining atmospheric humidity; the germination and spore formation limits were 70 and 74 per cent. relative humidity, respectively, at the optimum temperature of 31° [C.]. In practical storage trials with unpacked dried vegetables at 31°, 77 per cent. relative humidity was the lower limit for risk of spoilage by *A. glaucus*. No other dried products are as sensitive to fungal damage as vegetables.

HICKMAN (C. J.) & ASHWORTH (D.). **The occurrence of Botrytis spp. on Onion leaves with special reference to B. squamosa.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 153–157, 1 pl., 1 fig., 1943.

A die-back disease of onion foliage characterized by pale spots and wilting, followed by death of the leaves from the tip downwards, and apparently restricted to the autumn and winter, was studied by the authors during 1941 and 1942. Three species of *Botrytis* were isolated from diseased leaves: *B. squamosa*, recorded for the first time in England, was present and predominant on ten occasions from widely separated localities; *B. cinerea*, which appeared only twice (once in association with *B. squamosa*); and a third, as yet unidentified, species. No experiments were carried out to test the pathogenicity of the fungi. The disease is believed to be a case of facultative parasitism, infection being governed either by increased susceptibility of the host during autumn and winter as a result of adverse weather conditions, by attack by downy mildew (*Peronospora schleideniana*) [*P. destructor*], with which the *Botrytis* infection is sometimes associated, and by the favourable effect of the relatively moist conditions on the growth of *B.* spp.

BLACKFORD (F. W.). **Downy mildew and powdery mildew of the Cucumber.**—*Qd agric. J.*, lvii, 3, pp. 164–165, 1 fig., 1943.

The two most destructive diseases affecting cucumbers in Queensland are downy mildew [*Pseudoperonospora cubensis*: *R.A.M.*, xxi, p. 317] and powdery mildew [*Erysiphe cichoracearum*: ibid., xx, p. 509]. Both are generally to be found in

every cucumber crop in the State; they nearly always occur together, and such dual infection often produces heavy losses. Of the two, *P. cubensis* is the more serious.

Infection of cucumbers by downy mildew can be prevented by spraying with home-made cuprous oxide mixture (3 gals. of stock solution per 40 gals. water), or a commercial equivalent. Spraying or dusting should be started soon after the plants have appeared above the ground, applications being made as often as may be necessary to keep the new growth covered. Both surfaces of the leaves should be thoroughly treated. Powdery mildew may be checked by dusting with equal parts of sulphur and hydrated lime, or using a wettable or colloidal sulphur. As this treatment kills the fungus, applications may be delayed until infection appears. To control both diseases together a combination mixture of a wettable or colloidal sulphur and home-made cuprous oxide or a commercial equivalent may be used, or a dual-purpose dust may be substituted.

Dillon Weston (W. A. R.) & Taylor (R. E.). **An abnormal growth on Mushrooms.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 144–145, 1 fig., 1943.

A knob-like intumescence observed by the authors on the pileus of a cultivated mushroom [*Psalliota campestris*] is believed to be somewhat similar to those described for 'rose-comb' disease [*R.A.M.*, xvii, p. 791]. The mushrooms were grown in a garage where oil had been stored, a circumstance possibly conducive to the disease.

Teakle (L. J. H.), Johns (H. K.), & Turton (A. G.). **Experiments with micro elements for the growth of crops in Western Australia. IX. Copper deficiency of Currants at Gingin and its correction.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xx, 3, pp. 171–184, 6 figs., 1943.

Currant and sultana vines at Gingin, Western Australia, developed an unthrifty habit of growth, which was ascertained to be due to copper deficiency in the soil [cf. *R.A.M.*, xxii, p. 246]. In five years currant vines had only just reached a height of about $2\frac{1}{2}$ ft. from ground-level. The stems were scarcely more than $\frac{1}{2}$ in. thick, and the bark was rough and unhealthy. The canes were short, internodal growth was greatly restricted, and the wood failed to mature normally. The leaves were small, pale, and only slightly indented. Experimental treatments demonstrated that the condition responded to applications of copper sprays or copper fertilizers, or to a combination of these. Replanted vines showed vigorous establishment on the sites of the old vines, when treated with copper. The treatment recommended is annual copper spraying and the use of copper-containing fertilizers; as a soil dressing an application of copper sulphate at the rate of 1 cwt. per acre should suffice for several years.

Tisdall (A. L.). **Drainage investigations in the horticultural soils of the Murray Valley.**—*Pamph. Coun. sci. industr. Res. Aust.* 113, 23 pp., 1 pl., 1 diag., 2 graphs, 1942. [Photo-lithographed.]

Unduly high water tables, with their attendant damage to horticultural plants both from waterlogging and the excessive absorption of the soluble salts accumulated in the root zone, have been a major problem in the irrigation areas of the Murray Valley for many years. Annual autumn surveys were made of the condition of sultana vines on three sites at the Merbein Station from 1938 to 1941, inclusive, on the basis of which the plants were divided into six categories, viz., (1) good: vines healthy, no salt injury; (2) fair plus: slight salt damage, generally to the leaf margins, with some premature defoliation, but sufficient pruning wood still being produced; (3) fair: growth stunted, canes inadequate for pruning, early leaf-shedding, sometimes weak 'second growth' of laterals; (4) fair minus: more

conspicuous stunting, canes reduced to about half the normal number and usually short, premature defoliation, and frequent 'second growth'; (5) bad: vines just alive, no satisfactory canes, all growth short and severely affected; (6) dead. In the first year of drainage (1939), no improvement was observed in the health of the vines as compared with the previous year, but in 1940 and 1941, there were progressively fewer vines in the fair minus, bad, and dead classes. It is concluded that in most of the local sandy loam and loam soils the reclamation of water-logged areas by means of drains is not only practicable but economically sound. Those provided in the vine field were 6 ft. deep and spaced 44 or 88 ft. apart, the latter distance having been found perfectly satisfactory.

Woods (M. W.) & Dubuy (H. G.). **Evidence for the evolution of phytopathogenic viruses from mitochondria and their derivatives. I. Cytological and genetic evidence. II. Chemical evidence.**—*Phytopathology*, xxxiii, 8, pp. 637–655, 4 figs., 4 diags., 1943; 9, pp. 766–777, 1 fig., 2 graphs, 1943.

The writers consider that viruses may have been derived from constituents of the chondriosomes controlling variegations, rather than from pre-existing parasitic micro-organisms [cf. *R.A.M.*, xxi, p. 229]. In support of this theory, experiments are described in which a white mosaic-sectorial variegation of *Euonymus radicans*, apparently of the chondriosome-controlled type, was transmitted by grafting to a previously non-variegated stock of the same species. Further weight is lent to the hypothesis of the origin of viruses in plastic mutations by the predominantly matroclinous inheritance of both viruses and variegation.

In the second paper chemical evidence is provided of the occurrence of a ribose nucleoprotein in the plant plastid of the same general type constituting viruses. The resemblance of the chromoprotein complex from plastids to the complex as it occurs in the living plant was shown by the results of spectral analysis and by its chemical and physical characteristics.

Перечень вредителей, болезней и сорняков с.-х.—растений—объектов внешнего карантина, установленный для СССР на 1940 год. [List of pests, diseases, and weeds of economic plants—objects of external quarantine, approved for the U.S.S.R. for the year 1940.]—62 pp. Сектор карантина растений и Центральная карантинная лаборатория [Section Plant Quarantine and Central Quarantine Laboratory], 1940. [Received February, 1944.]

This list of pests and diseases of economic crops subject to quarantine restrictions in the U.S.S.R. supplies information on the host range, geographical distribution, and means of dissemination of the various parasites, which are arranged under the crop plants.

Ahlberg (O.), Lihnell (D.), & Wahlin (B. J. O.). **Nyare undersökningar över sjukdomar och skadedjur på fruktträd, bärbuskar och köksväxter.** [Recent investigations on diseases and pests of fruit trees, small fruits, and kitchen-garden plants.]—*Sverig. pomol. Fören. Årsskr.*, xliv, pp. 99–112, 1943.

The following items occur in this report, besides some noticed from other sources. In an attempt to economize in the use of copper, C. Stapel and H. Petersen (*Tidsskr. Planteavl*, xlvii, 1943) tested a number of copper, sulphur, and organic chemical fungicides in Denmark against apple scab [*Venturia inaequalis*] and potato blight [*Phytophthora infestans*]. Although giving adequate control of the former disease, the compounds tested were inferior to standard Bordeaux, while lime-sulphur sprays of the various copper compounds, though as effective as 1 per cent. Bordeaux mixture against the latter disease, were inferior to 2 per cent. Bordeaux.

N. F. Buchwald's inoculation experiments and conidial measurements (ibid., xlvii, pp. 521–528, 1943) yielded irrefutable evidence that *Sclerotinia fructigena* is the agent of a hazel nut [*Corylus avellana*] disease characterized by the profuse development of yellow fungal 'cushions' on the nuts, which fall prematurely.

Potato virus diseases are spreading to such an extent in Sweden [*R.A.M.*, xxii, p. 446] that their control is becoming a really grave problem for plant pathologists. In the summer of 1941 officials of the Plant Protection Institute visited 54 potato fields in different parts of the country, of which 36 were infected by viruses, many with up to 75 per cent. of the plants showing unmistakable symptoms. In 17 fields covering 9 ha. in the Linköping district, an average of 10 per cent. of the plants were affected by viruses, mostly of a severe type, and none of the fields was entirely healthy. In 1942 only four out of 112 fields (120 ha.) were free from virus diseases, of which mosaic occurred in 92, aucuba mosaic in 4, rugose mosaic in 92, streak in 13, and leaf roll in 34, the average incidence of infection being 36 per cent. (7 per cent. severe). Generally speaking, as in other countries, potato degeneration of virus origin is more prevalent in low-lying regions, such as Scania and Halland, and coastal districts than at higher altitudes and further inland. It also assumes a more virulent form in the south than in the north.

Annual Report, Cawthron Institute, Nelson, New Zealand, 1941.—35 pp., [? 1942]; **1942.**—32 pp., [? 1943].

In the first of these reports [cf. *R.A.M.*, xx, p. 559] it is stated that during 1940–1 the best control of magnesium deficiency of apple trees was associated with the use of magnesium carbonate at the rate of 2 lb. per tree. Chemical analyses of leaf samples from the experimental plots revealed slight increases in the magnesium content of the leaves as a result of the application of different magnesium top dressings. In the 1941–2 season further improvement was observed to follow in the treated trees, as a result of the dressings applied in previous seasons, particularly in Sturmer trees at Braeburn. Dolomite, 6 lb. per tree, markedly improved the foliage.

Kondine tomatoes and allied varieties in Nelson are affected by 'hard core', in which a high percentage of tough white or greenish-white tissue is present. Incidence appears to be influenced by seasonal and climatic factors. Records of 100 plants in one garden showed that every plant became affected. The first and second fruit bunches had a higher percentage of affected fruits than the bunches higher up while in many cases fruit from the top was relatively unaffected. On the whole, plants with the heaviest crop had the highest percentage of hard core. Of a number of chemicals injected into the stems of these plants, boron and magnesium acetate favoured the trouble, while ammonium chloride appeared to reduce its incidence.

No significant differences in the incidence of initial tobacco mosaic in the field were observed when the tobacco was planted on areas where the previous crop had been 'pulled' or, alternatively, 'disked in'.

In the second report it is stated that apple leaves showing the brown blotching characteristic of magnesium deficiency were shown to be low in this element by a colorimetric test. In 1942–3 still further improvement followed the applications of magnesium to the Sturmer apple trees at Braeburn. There appeared to be no advantage in increasing the amount of ground dolomite above 12 lb. per tree, whether this latter amount was used in one application or in two. The evidence obtained has proved the value of ground dolomite, magnesium carbonate, and magnesium sulphate in the treatment of magnesium deficiency, but three or four years must often elapse before satisfactory control results in badly affected orchards. Ground dolomite gave the most consistently good effects. Magnesium sulphate sometimes acted more rapidly, but the control obtained was less lasting.

The notification service in connexion with the ascospore maturity of apple brown rot [*Sclerotinia fructicola*] and black spot [scab: *Venturia inaequalis*] was continued for the benefit of growers in the Nelson area.

Tomato 'cloud' was favoured by steam sterilized soils. The amount of 'cloud' fruit was highest in the bottom bunch (14·1 per cent.), diminishing until the bunches above the fifth showed little if any signs of the trouble. The percentage of cloud in the Institute glasshouse was less on the eastern and southern sides than on the western and northern.

Further studies on tobacco mosaic showed that percentage incidence was higher among 'pricked out' than among 'bed sown' plants. Infection in the continuous tobacco and alternate oats–tobacco plots amounted to 2·3 and 1·8 per cent., respectively. The incorporation of tobacco trash in the soil of a seedling bed gave a comparatively high increase in infection. Inoculations of tobacco seedlings with soil suspensions from beds treated with tobacco trash five months before gave positive results. Milk spray (1 in 10 with water) afforded some protection in seedling beds.

Bertus (L. S.). **Plant pathology.**—*Adm. Rep. Dir. Agr., Ceylon, 1942*, p. D5, 1943.

During the period covered by this report [cf. *R.A.M.*, xxii, p. 197], *Fomes lignosus* was observed, for the first time in Ceylon, as the agent of a root disease of cassava on [*Hevea*] rubber estates, where its occurrence on the food crops may be used as an indicator of the presence of infected roots and stumps.

A sap-transmissible virus was implicated in the etiology of a mosaic disease of vegetable marrow [cf. ibid., xxiii, p. 125] and snake gourd (*Trichosanthes anguina*).

Tomatoes also suffered from a virus disease causing leaf curl and stunting, which is communicable to healthy plants by means of grafting and whiteflies [Aleyrodidae], but not through the sap.

A disorder of young citrus, characterized by reduced growth and a 'staghorn' appearance of the plants, combined with debility and the presence of branching gum canals in the cambial zone, is somewhat reminiscent of exanthema [ibid., xi, p. 628 *et passim*].

Mycology.—*Rep. Dep. Agric. Burma, 1941–42* and *1942–43*, pp. 4–9, 1943.

During the periods under review [cf. *R.A.M.*, xix, p. 70] rice blast (*Piricularia oryzae*) was fairly prevalent in the Delta. The immersion of seedlings in a 2 per cent. copper sulphate solution before transplanting gave encouraging results.

The smut of *Sorghum dochna* caused by *Sphacelotheca sorghi* was effectively combated by four hours' soaking in water at room temperature followed by spreading and drying in a room; 15 minutes' immersion in 2 per cent. copper sulphate; and dusting with finely powdered sulphur, the three methods reducing the incidence of infection from 9 to 0·8, 0·2, and 0·1 per cent., respectively, while the comparative figure for drying in the sun (shade temperature of 106° F.) after immersion was 4 per cent.

The same host was severely attacked by sugary disease (*Sphacelia sorghi*) at Mandalay and Tatkon. The sclerotia of a species of *Claviceps* were detected among the dry grain used as cattle fodder, in some cases with fatal results.

Phytophthora colocasiae was responsible for a rather serious foot rot of *Piper betle*, destroying some 50 per cent. of the vines in one locality, where the timely application of 1 per cent. Bordeaux mixture arrested the further spread of the disease.

Some improvement in the health of onions attacked by *Alternaria* sp. was obtained by spraying the plants a week before and a month after transplanting with 1 in 2,500 copper sulphate.

Among the organisms associated with a coco-nut disease of the top-rot type,

causing losses of half the palms in some plantations, were a species of *Fusarium* and a Phycomycete. The first symptom is the wilting of the youngest leaves in the centre of the crown, followed by that of the surrounding foliage, with the exception of the oldest peripheral leaves. Affected palms cease to grow, no more fruits are produced, and those already formed shrivel, while the crown may be shed at an advanced stage. The rot attacks palms of all ages.

Storage of mangoes at 36° and 40° resulted in physiological breakdown of the fruit within a fortnight. A species of *Gloeosporium* and *Dothiorella* [*Botryosphaeria*] *ribis* caused lateral and stem-end rot, respectively, of the stored fruits. Storage temperatures of 36° and 40° were also unfavourable to mangosteens, which developed hardening of the rind and physiological breakdown within a fortnight; *Diplodia natalensis* was determined as the agent of stem rot. *Thielaviopsis* [*Ceratostomella*] *paradoxa* and *Rhizopus* sp. were the chief sources of loss among stored pineapples.

The following were observed for the first time in Burma: *P. colocasiae* on *Colocasia* sp., and a species of *Nematospora* and *A. citri* on mandarin orange fruits.

The inoculation of trap pits with *Metarrhizium anisopliae* reduced the number of living grubs of the rhinoceros beetle [*Oryctes rhinoceros*] pest of coco-nut by 15 per cent. in one locality and 70 per cent. in another.

The straw mushroom (*Volvaria diplasia*) continued to find favour among cultivators [ibid., xx, p. 100].

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, liv, 11, pp. 503–506, 4 figs.; 12, pp. 559–564, 9 figs., 1943.

In these notes on plant diseases in New South Wales it is stated that leaf mould [*Cladosporium fulvum*: *R.A.M.*, xxii, p. 281] is locally one of the most serious diseases of glasshouse tomatoes. Infection can be reduced by regulating watering and ventilation so as to lower the humidity, but the only effective spray is shirlan A.G. (1 pint per 40 gals.). Spraying should be started a few weeks after transplanting, and should be continued at fortnightly intervals for as long as is practicable. Destruction of the mould by sulphur fumigation (1 lb. per 1,000 cu. ft.) before clearing out the old vines is preferable to fumigating cleaned houses.

Sweet potatoes are attacked by scurf or soil stain (*Monilochaetes infuscans*) [ibid., xxii, p. 419]. New records include *Sclerotinia sclerotiorum* on *Chrysanthemum cinerariifolium*, *Cephaleuros mycoidea* [ibid., xx, p. 111] on citrus, *Septoria cucurbitacearum* [ibid., xvii, p. 364] on cucumber, *Rhizoctonia* [*Corticium*] *solani* causing crown and root rot of *Gerbera jamesonii*, and pea enation [mosaic] virus on peas.

The chief virus diseases causing deterioration of potatoes in Australia are leaf roll, virus X, virus A, and virus Y. Virus X is present throughout all commercial varieties. The Factor potato, which is that most commonly grown in New South Wales, possesses field immunity from virus A, and accordingly does not show symptoms of crinkle and related forms of mosaic, but the Snowflake, Carman, and Brownell varieties are susceptible and the combination of viruses A and X in these varieties leads to the development of mosaic symptoms. Aucuba mosaic (virus F) is sometimes found in New South Wales. To eliminate strains of virus X from the local seed stocks the existing stocks will have to be entirely replaced [ibid., xxii, p. 468].

During the spring of 1943 late blight of potatoes [*Phytophthora infestans*] developed in epidemic form in some coastal areas. To retard the development of infection during storage the tubers should be kept at 38° F. or less.

Heavy losses were caused to cherry growers as a result of attack by brown rot (*Sclerotinia fructicola*) [ibid., xxi, p. 244; xxii, p. 470]. Recommendations for control include stringent plant sanitation combined with spraying just before or at bud-swell with Bordeaux mixture (6–4–40) or lime-sulphur (1 gal. to 20 gals. water).

Further treatments should be applied at blossoming, at 'shuck-fall', and at intervals of three to four weeks from shuck-fall until harvesting; if the weather is very humid, spraying should be effected during the seven days before harvest. Sprays may also be applied to cherries between pickings. At three stages the following sprays are recommended for all stone fruits except early peaches and apricots in coastal areas: lime-sulphur (1 gal. to 160 gals. water), colloidal sulphur (2 lb. to 100 gals.), or wettable sulphur (5 lb. to 100 gals.). Early peaches in coastal districts should be treated only with colloidal or wettable sulphur. Early apricots in the same localities should be sprayed with Bordeaux mixture ($1\frac{1}{2}$–1–80 plus $\frac{1}{2}$ gal. white oil) or with copper oxychloride ($\frac{1}{2}$ lb. to 80 gals. plus $\frac{1}{2}$ gal. white oil).

Plant diseases and insect pests. Notes by the Biological Branch.—*J. Dep. Agric. Vict.*, xli, 11, pp. 551–555, 558, 8 figs., 1943.

During 1942–3 broad bean seed crops in Victoria were heavily infected by anthracnose due to a species of *Ascochyta*, probably *A. fabae* [*R.A.M.*, v, p. 699; xi, p. 143]. The disease was particularly serious in the Geelong area, some crops at Leopold, Wallington, and Drysdale showing 100 per cent. infection. Infected plants bear dark brown, circular or oval dead areas up to $\frac{1}{2}$ in. in diameter on the leaves, the lower leaves being usually most severely affected. The spots often develop growth rings in the form of concentric circles; the pycnidia are present in the central ring. The pods are attacked as they form, and show conspicuous dark brown or black, circular, sunken spots, which may unite, destroying most of the pod surface. Finally a flesh-pink mass of spores develops in the centre of each lesion. The fungus penetrates the seed through areas in contact with the pod. Infected seeds show brown, circular markings on the coat, sometimes with the concentric ring formation, which is also present on the pods. In affected areas seed should be used that has been obtained from an arid locality where the disease is not likely to develop. A three years' rotation should be adopted, and refuse from all diseased crops burnt.

Tomato spotted wilt is more prevalent in the Melbourne area than in any other part of Victoria. This is attributed to the large number of infected hosts (especially ornamentals) growing in the metropolitan area. Over 50 per cent. infection is not unusual. Both vectors, *Thrips tabaci* and *Frankliniella insularis*, are present. Experimental evidence did not indicate that a tartar emetic-brown sugar spray gives satisfactory control [ibid., xxii, p. 115]. Commercial growers are advised to rogue out and replace diseased plants and practise clean cultivation. It is advisable to plant two tomatoes to each stake, so that if one becomes infected it can be replaced; it is very seldom that two plants on one stake are attacked simultaneously.

Plane trees [*Platanus*] in Victoria are frequently affected by leaf scorch (*Gloeosporium nervisequum*) [ibid., xii, p. 735; xix, p. 444; xx, p. 611]. Pollarding plays an important part in control, since it removes the infected twigs in which the fungus overwinters. The prunings should be burnt, and the trees sprayed with Bordeaux mixture (4–4–40) at bud-burst and about a week later. In wet seasons further applications should be made at fortnightly intervals.

Science for the farmer.—*Rep. Pa agric. Exp. Sta., 1942–43* (*Bull.* 446), 44 pp., 16 figs., 1943.

This report [cf. *R.A.M.*, xxii, p. 238] contains the following items of phytopathological interest. C. F. Noll states that the 90A–27 oats variety is resistant to smut [*Ustilago avenae* and *U. kolleri*]; it is widely grown in certain parts of Pennsylvania, a considerable acreage having been certified for seed during the past few years. Beaver, a selection from 90A–27 also developed by Dr. Noll, was released for distribution in 1943.

Certain strains of potatoes immune from blight [*Phytophthora infestans*] and selected by W. R. Mills have shown sufficient promise in trials at the State College to be placed in regional tests.

Elliott (Charlotte). **Recent developments in the classification of bacterial plant pathogens.**—*Bot. Rev.*, ix, 10, pp. 655–666, 1943.

Recent important contributions to the taxonomic study of bacterial plant pathogens are summarized: most of the work referred to has been noticed from time to time in this *Review*.

Thomas (J. E.) & Riker (A. J.). **The influence of known chemicals on the initiation of pathological growth and symptoms resembling those from certain viruses.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1119, 1943.

Of 31 chemical compounds mixed in a lanoline paste and applied to the decapitated stem tips of sunflower, marigold, tomato, Paris daisy [*Chrysanthemum frutescens*], velvet leaf, *Kalanchoë*, and *Bryophyllum pinnatum* plants 1½ to 2 in. above inoculations with the attenuated strain of *Phytomonas* [*Bacterium*] *tumefaciens* [*R.A.M.*, xvii, p. 798; xviii, p. 580], 12 were found to be capable of 'activation' of the tissues surrounding the sites of inoculation, the most powerful being indole-butyric acid, alpha naphthylacetamide, and beta-naphthoxyacetic acid. Common responses to treatment with the growth substances included axillary bud and abscission layer inhibition, aerial root stimulation, stem-thickening, epinasty, gall formation, and foliar distortions, the last-named presenting close similarities with certain disorders of virus origin; they were, however, not transmissible to healthy plants and recovery eventually took place.

Conn (H. J.). **Validity of the genus Alcaligenes.**—*J. Bact.*, xliv, 3, pp. 353–360, 1942.

At present only one soil bacterium has been referred to the genus *Alcaligenes*, viz., *A. radiobacter*, and it is obviously out of place here if the type species, *A. faecalis*, an intestinal organism requiring organic nitrogen, be accepted. On the other hand, *A. radiobacter* closely resembles the legume nodule bacteria (*Rhizobium* spp.) and those responsible for crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) and hairy root (*P.* [*Bact.*] *rhizogenes*). For the accommodation of these nearly related species, and others that may be found similar in morphology and physiology, the new genus *Agrobacterium* is proposed, with *A. tumefaciens* as the type species. It is characterized by small, short, non-spore-forming rods, typically motile by 1 to 4 peritrichous flagella and occurring primarily in the soil or as pathogens attacking roots or causing stem hypertrophies. The organisms comprising this group are usually Gram-negative, produce no acid or gas in glucose-peptone media, and liquefy gelatine slowly or not at all.

Anderson (H. W.). **Action of clavacin on certain phytopathogenic bacteria.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1109, 1943.

Clavacin, an antibiotic substance derived from *Aspergillus clavatus* [*R.A.M.*, xxii, p. 91], was tested for its antagonism to 20 species of bacteria in dextrose broth, comprising seven of *Xanthomonas*, five each of *Pseudomonas* and *Corynebacterium*, two of *Agrobacterium*, and one of *Bacterium* (*Bact.* [*X.*] *stewarti*), the sterile, unconcentrated filtrate used for this purpose containing four Oxford units per ml. Four of the organisms were killed at a strength of 2 per cent. or less, nine at 4, and two at 6, the remaining five surviving but undergoing bacteriostasis at 4 per cent. Clavacin further exerted a bacteriostatic action on 10 of the 20 test species at 1 per cent. or less and on seven at 2 to 3 per cent. The Gram-negative *X. stewarti* and *X. pruni* (which is refractory to penicillin) were the most sensitive to contact with

clavacin, and *Staphylococcus aureus*, included for comparison, responded in a similar manner.

Neish (A. C.) & Hibbert (H.). **Studies on plant tumours. Part II. Carbohydrate metabolism of normal and tumor tissues of the Beet root. Part III. Nitrogen metabolism of normal and tumor tissues of the Beet root.**—*Arch. Biochem., N.Y.*, iii, 2, pp. 141–166, 1 graph, 1943.

A comparative study at McGill University, Montreal, of respiration, fermentation, and the Pasteur effect (defined by some workers as the effect of oxygen in inhibiting production of the fermentation product, and by others as the effect of oxygen in decreasing the rate of carbohydrate catabolism of fermenting tissue) of normal and crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) beetroot tissues [*R.A.M.*, xx, p. 154; xxii, p. 423] revealed, *inter alia*, the conversion of 75 per cent. of the carbohydrate to unknown substances by the tumour tissue, in which alcoholic fermentation is active and lactic acid fermentation absent; the presence of a well-developed Pasteur effect in both tissue types; the increased tendency of tumour tissue to synthesize proteins, primarily under aerobic conditions (this applies also to healthy material); the replacement by both tissue types of glutamine by asparagin; and the partial fixation of amide nitrogen by both types.

Levi (I.), Michaelis (M.), & Hibbert (H.). **Studies on plant tumours. Part IV. Oxidases in normal and tumor Beetroot tissue.**—*Arch. Biochem., N.Y.*, iii, 2, pp. 167–174, 1943.

The influence of dihydroxymaleic and ascorbic acids, catechol, hydroquinone, and resorcinol on the oxygen consumption of normal and crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*) tissue [see preceding abstract] was investigated. An increased oxygen uptake was observed with all the substances except resorcinol, which inhibits catechol oxidase in both types of tissue. The increased ascorbic acid content of the galls is in part explained by their reduced ascorbase content.

Thorold (C. A.). **Witches' broom disease investigations. VII. Observations on direct control.**—*Trop. Agriculture, Trin.*, xx, 12, pp. 239–241, 1943.

In a small experiment carried out in Trinidad on the direct control of cacao witches' broom (*Marasmius perniciosus*) [*R.A.M.*, xxiii, p. 9], six blocks each of 144 trees of one budded clone or of the same number of seedling progeny from one individual tree were divided into two equal plots of 72 trees. In one half of each block the brooms were removed once every month for two and a half years, while in the other half they were left on the trees. A total of 488 brooms formed on the trees from which the brooms were removed, as against 440 on those on which they were allowed to remain. The treatment thus gave no control.

To ascertain whether there was any evidence for the view that neglected neighbouring fields may be detrimental to an estate where broom removal is carried out, observations were made in six fields on the Non Pareil estate. The results showed that the highest percentage of diseased pods (24·5 per cent.) occurred in a field entirely surrounded by neglected properties, but the field with no neglected neighbours had 19·2 per cent. diseased pods, while two other fields partially bounded by neglected ones had only 16·3 and 18·5 per cent. infection, respectively.

Butter-fat content of 'black' Cacao.—*Bull. imp. Inst.*, xli, 4, pp. 234–236, 1943.

Preliminary experiments were carried out by J. West, Botanist to the Department of Agriculture, Nigeria, to determine the effect on the butter fat and free fatty acid content of cacao beans of the black pod disease caused by *Phytophthora palmivora*. The analysis of ten fermented samples of healthy and infected beans (five of each) from individual trees in a single experimental area showed the butter fat content

of the latter to be uniformly higher than that of the former. In another test on random samples of beans from sound and dead pods a similar result was obtained, but no difference was detected between the free fatty acid (as oleic acid) contents of the two lots.

GREANEY (F. J.) & MACHACEK (J. E.). **Seed-borne diseases of cereals in Manitoba—a survey, 1937–1942.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1111, 1943.

Among the many fungi isolated from samples of wheat, oats, barley, and rye seed-grain collected yearly in Manitoba from 1937 to 1942 were *Helminthosporium sativum* on wheat [cf. *R.A.M.*, xx, p. 566], barley, and rye, *H. avenae* on oats, and *H. teres* on barley, these being the predominantly pathogenic species. Oats in particular commonly yielded several harmless species of *Fusarium*. Soil-bed tests demonstrated a high positive correlation between the percentage of seeds attacked by *H. sativum* and *H. avenae* and the incidence of disease in the subsequent seedling stand. In wheat, but not in barley, seed infection by *H. sativum* coincided with low germination. Of the wheat samples tested 96·4 per cent. were virtually free from surface-borne smut [= bunt (*Tilletia caries* and *T. foetida*): loc. cit.], whereas the spore loads of smut on over 80 per cent. of the oats [*Ustilago avenae* and *U. kolleri*] and barley [*U. nuda* and *U. hordei*] were sufficiently high to necessitate seed treatment. Each year nearly half (46 per cent.) of the wheat seed stocks required treatment for disease control.

CARROLL (P. T.). **Some factors influencing lodging in cereals.**—*J. Dep. Agric. Eire*, xl, 2, pp. 280–285, 1943.

In this broadcast talk the author gives notes on the resistance of wheat, oats, and barley varieties to lodging, and advocates crop rotation to avoid the increase and spread of root-rotting fungi which endanger the standing power of the crop.

FISCHER (G. W.). **Some evident synonymous relationships in certain graminicolous smut fungi.**—*Mycologia*, xxxv, 6, pp. 610–619, 4 figs., 1943.

In this paper the author calls attention to instances of synonymy in the grass and cereal smuts, and recommends desirable consolidations. Fischer and Holton recently recommended uniting *Ustilago avenae* (causing loose smut of oats) and *U. perennans* (smut of *Arrhenatherum elatius*) [*A. avenaceum*] because of their demonstrated genetic relationship and morphological identity [*R.A.M.*, xxi, p. 11]. Further work has now shown that *U. nigra* should be included in the consolidated species [ibid., xxii, p. 298]. The legitimate binary name under the provisions of the International Rules would appear to be *U. avenae*, though *U. nigra* would be more descriptive. *U. hordei* and *U. kolleri* are morphologically not distinct, and should be regarded as specialized varieties of a morphological species which by priority should be designated *U. hordei*. *U. tritici* and *U. nuda* are identical in all respects except pathogenicity, and should be regarded as specialized varieties of the same morphologic species, which by priority should bear the name *U. tritici*. The author's studies also indicate that *Urocystis tritici* and *U. agropyri* are not morphologically separable, while *U. occulta* is fairly distinct because of the incomplete investment of the spore balls. Otherwise, the three 'species' are inseparable on the basis of size and shape of spore balls, number of spores contained in them, and size and shape of the spores. *U. agropyri* has been present in the United States for several decades, and over 30 species in 10 genera of grasses are known to be hosts. Herbarium specimens of flag smut under the name *U. agropyri* from all 10 genera of grasses were examined, and more variation was observed among the collections of *U. agropyri* than between the species as a whole and *U. tritici*. As *U. agropyri* and *U. tritici* are morphologically identical, it appears logical to consider them as one species. If flag smut of wheat were to continue to be considered as a separate

species, then the smut on each of the ten other genera of grasses would also merit specific distinction. The result would be nearly a dozen 'species' causing flag smut, none of them, probably, separable morphologically. In view of this, and considering that several species of grasses are susceptible to *U. tritici* [ibid., xxi, p. 293], it is recommended that this species and *U. agropyri* should be combined under the latter name, which has priority. It might even be desirable to include *U. occulta* in the composite species, but at present it appears preferable to keep it separate because of the incomplete investment of the spore balls by the sterile cells.

Woolford (B. C.). **Deep South gets new, anti-rust recruits.** *Sth. Seedsm.*, vi, 10, pp. 9, 53, 57, 2 figs., 1943.

Austin soft red winter wheat (selection 41-16-3-3 of the Texas Agricultural Experiment Station), derived from a single plant of a cross between Hope spring and a pure line strain of Mediterranean winter, is highly resistant to stem and leaf rusts [*Puccinia graminis* and *P. triticina*] and loose smut [*Ustilago tritici*].

Tunis barley has consistently showed high resistance to leaf rust [*P. anomala*]. A new smooth-awned barley named Texan, resistant to mildew [*Erysiphe graminis*] and stripe [*Helminthosporium gramineum*], is now being increased for distribution to growers.

Seed of the new Ranger and Rustler oats [*R.A.M.*, xxiii, p. 98] resistant to crown rust [*P. coronata*] is now available from a number of sources in Texas. Verde, the offspring of a double cross possessing a high degree of resistance to crown rust and withstanding stem rust [*P. graminis*] fairly well, but not very winter-hardy, should be ready for the market in the autumn of 1944.

Lindfors (T.). **Är Berberislagen ineffektiv?** [Is the Barberry law ineffectual?] *Landtmannen, Uppsala*, xxvii, 49, pp. 1040–1041, 1943.

During the four years since the outbreak of war the scarcity of farm labour in Sweden has resulted in a profuse new growth of barberries, mostly in the form of small plants which have sprung up either from seed, or more commonly from the surviving roots of 'eradicated' bushes. If the young growth is permitted to flourish for another few years, the position as regards its extermination will revert to that obtaining at the outset of the barberry eradication campaign [against *Puccinia graminis*: *R.A.M.*, xiii, p. 84]. In this connexion attention is drawn to some anomalies in the application of the existing regulations and a plea made for amendments to insure uniformity of interpretation over the whole country.

Tyner (L. E.) & Broadfoot (W. C.). **Field tests of the differential reaction of Wheat varieties to root rot.** *Sci. Agric.*, xxiv, 4, pp. 153–163, 1943.

In tests carried out since 1932 at Edmonton, Alberta, on varietal resistance in wheat to the root-rotting fungi *Helminthosporium sativum*, *Ophiobolus graminis*, and *Fusarium culmorum* [*R.A.M.*, xx, p. 397], the method of natural soil infestation by continuous cropping to wheat was adopted. Thus, the infection rating data obtained were indicative of the root-rot complex. One hundred seeds per 12 ft. row were planted at a depth of 2 in. In every tenth row Marquis wheat was planted as a guide in estimating the amount of heterogeneity in the experimental area. The planting dates varied, the mean being about 1st May. Notes were made during the ten days preceding maturity by cutting down crowns longitudinally and estimating disease severity on a percentage basis according to the relative degree of lesioning present in the crown tissue, and by examining the lesioning present in the other parts of the root system. In this way, the identification of inherent resistance was based on actual disease symptoms, not on yield.

The data obtained showed that, in spite of the influence of climatic factors on infection, some of the 148 varieties tested did appear to display more inherent

resistance than others, particularly Red Fife, Kota, O.A.C. 35, White Russian, Blue Ribbon, Huron, Kitchener, Double Cross, Caesium, Kubanka, Red Russian, Swedish, Major, McMurachy's Selection, and White Head. Drought markedly influenced the final rating. Early drought, by destroying parts of the root, opens the way for soil-borne pathogens and saprophytes. Drought experienced towards ripening produces a discoloration of the crown tissue distinguishable with difficulty from root rot. In general, the inherent resistance of a variety can be more accurately estimated 4 to 7 days before maturation than during the seedling stage or in the intermediate period, because maximum symptom development takes place just before maturity.

It is important that all varieties should be planted at the same time, so that they may be subject to like conditions during most of the growing period, the harvesting being done at intervals of three or four days, corresponding to the dates of ripening.

As regards the comparative value of greenhouse and field tests for resistance, it is pointed out that in the former it is easy to bring about the death of all the seedlings, by increasing the inoculum, or to induce only very light infection, by decreasing it, neither of which is satisfactory. Under such artificial conditions the behaviour of the pathogen becomes much more erratic than it is in the field, where the soil microflora is more stabilized. Also, under greenhouse conditions, seedling material (which is unsatisfactory for resistance studies) cannot be brought to natural maturity. Under field conditions, on the other hand, in naturally infested soil, infection of the host develops more gradually, and later in the post-seedling stage, though the plants mature more or less normally. However, even under field conditions, if inoculum is applied as a spore suspension on the seed, or is put into the drill in other forms, severe infection may develop, and a high percentage of the seedlings be killed before or soon after emergence; in this way, the remaining plants, having less competition, become abnormally vigorous. Hence, the difference in numbers of surviving seedlings is of doubtful value as an indication of resistance. For these reasons it would appear to be essential that tests for varietal resistance should be carried out only under field conditions in naturally infested soil.

Greaney (F. J.) & Wallace (H. A. H.). **Varietal susceptibility to kernel smudge in Wheat.**—*Sci. Agric.*, xxiv, 3, pp. 126–134, 1943.

Varietal tests conducted at several stations in Manitoba, Saskatchewan, and Alberta from 1935 to 1942 showed that, in general, varieties of *Triticum durum* were considerably more susceptible to kernel smudge, caused by *Alternaria* spp. [*R.A.M.*, xxi, p. 121] and *Helminthosporium sativum* [ibid., xxii, p. 297], than were those of *T. vulgare*. The varieties of hard red spring wheat tested ranked in order of susceptibility as follows: Apex, Thatcher, Marquis, Renown, Regent, and Garnet, an early-maturing variety which was highly resistant. Of the stem rust [*Puccinia graminis*]-resistant varieties tested, Apex and Thatcher were more susceptible than Renown and Regent. Extensive plating tests conducted with a large number of Manitoba samples of Apex, Thatcher, Renown, and Regent seed from crops of four seasons, 1939 to 1942, showed that Apex and Thatcher were slightly more susceptible to internal seed infection by the kernel smudge fungi than were Renown and Regent. Only a small proportion of the internally infected kernels exhibited external discoloration typical of smudge, indicating that although favourable conditions for infection of wheat kernels occur in Manitoba, those prevailing subsequent to infection are usually not conducive to the development of the disease.

Taylor (J. W.) & Harlan (H. V.). **Agronomic smut.**—*J. Hered.*, xxxiv, 10, pp. 309–310, 1943.

In two plantings at Aberdeen, Idaho, of Nakano Wase barley, using seed grown at Arlington, Virginia, one from central and the other from lateral kernels of the

same spikes, the incidence of loose smut [*Ustilago nuda*] in 1937 and 1938 was much higher in the latter than in the former (20·4, 10·6, and 15·1 compared with 6, 5·7, and 2·8 per cent. in the varieties Nakano Wase 51, 33, and 68, respectively). Esaw, a hybrid of Nakano Wase, reacted similarly with 7·5 per cent. smutted heads from the lateral as against 1·5 from the central kernels. In 1938 and 1939 large and small seeds of Nakano Wase 68 were separated by the Tyler screen and Hero fanning mill, respectively. In the former year the percentages of smut in heads from the small, medium, and large seeds were 17·5, 9·3, and 0, respectively, and in the latter, 17·3 to 19·6, 6·2, and 5·5, respectively. Very little smut occurred in Wisconsin Winter, in which the lemma and palet of the lateral kernels are interlocked or overlapped, the incidence in the heads from small and medium seeds being 2·6 to 3·1 and 1·4 per cent., respectively. The lateral flowers mature later than the central, thus permitting greater likelihood of infection, but this difference is not considerable except in such varieties as Nakano Wase, where the lemma and palet are open at flowering.

Stakman (E. C.), Levine (M. N.), & Loegering (W. Q.). **Races of Puccinia graminis avenae in the United States.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1118, 1943.

Races 1, 2, and 5 of oat stem rust (*Puccinia graminis avenae*) were until recently the only ones of serious importance in the United States. In 1940 and 1941, however, races 8 and 10 became increasingly prevalent, while in 1943 the widely distributed 8 comprised some 12 per cent. of all isolates and was responsible for substantial infection on Vicland, Boone, Tama, and other hitherto resistant varieties, mostly derived from Victoria × Richland crosses [*R.A.M.*, xxi, pp. 330, 441]. This race, together with 7, 10, and 12, which are also dangerous, was first detected in barberry-infested areas. Richland and White Tartar, the former susceptible only to races 8 and 10, and the latter to 7 and 12, have up to the present been largely used as parents in the breeding programme. The virulent races 4 and 6 have not yet been found in the United States, though occasionally recorded from Canada.

Mead (H. W.). **Seed-borne molds of Barley.**—*Commun. Wallerstein Lab.*, vi, 17, pp. 26–32, 1943. [Abs. in *Chem. Abstr.*, xxxvii, 22, pp. 6815-6816, 1943.]

The examination of Canadian and United States barley seed-grain samples revealed the presence of bacteria and fungi, the latter including smuts [*Ustilago hordei*, *U. nuda*, and *U. nigra*], agents of root rot, e.g., *Fusarium* [and *Helminthosporium*] spp., and saprophytic moulds. The smuts do not impair the germination of the seed, but in large quantities they may induce an objectionable flavour in the malt. The root rots cause seedling blight and often prevent germination, while some *F.* spp. spread rapidly on the malting floor. The species responsible for scab [*Gibberella zeae*] is toxic to man in the seed-borne form. Germination may be substantially lowered by *Penicillium* and *Rhizopus*, which also cause rotting and adversely affect the taste of the barley. *P.* and *Aspergillus* utilize the carbohydrates of malt kernels, thereby reducing the available extract. They also spoil the appearance of the malt, but do not seem to induce any loss of palatability in the beer made from it.

Dillon Weston (W. A. R.). **Diseases of Corn crops.** *J. Minist. Agric.*, l, 11, pp. 496–499, 1944.

During 1943 some of the later-sown barley in Britain was seriously affected with mildew [*Erysiphe graminis*], while yellow rust [*Puccinia glumarum*] was in many instances exceptionally severe on wheat. The resistance of Rivet wheat to *P. glumarum* almost amounts to immunity, and Little Joss, once past the seedling stage, is strongly resistant; very severe infection was, however, noted on Desprez

80 in southern districts. Take-all [*Ophiobolus graminis*] of cereals was prevalent, but not particularly severe. In East Anglia oats appear to be immune, and could therefore replace barley in the rotation. A take-all disease of oats occurs in Wales, northern England, and in Scotland, but is seldom serious; it is caused by a strain of *O. graminis* [*O. graminis* var. *avenae*: *R.A.M.*, xx, p. 159] which is able to attack wheat or barley to some extent, though the strain which attacks wheat or barley does not attack oats.

To obtain maximum corn yields and avoid losses from disease, farmers should choose a variety suited to the soil texture and the standards of fertility, should disinfect all seed corn (both winter and spring corn) before sowing with an approved organo-mercury seed dressing, and should prevent take-all by starving out the fungus in the soil by means of a suitable rotation.

Piper (C. S.). **Manganese deficiency in Oats.** — *Nature, Lond.*, cliii, 3876, p. 197, 1944.

Referring to Twyman's recent communication on manganese deficiency of oats [*R.A.M.*, xxii, p. 428], the author states that the work of Stout and Arnon on the effect of molybdenum on the growth of tomatoes was confirmed by him with regard to oats [ibid., xix, p. 727], so that the response obtained by Twyman to his group of seven elements cannot be separated from the response known to be due to one of them. In critical water-culture experiments careful consideration must be given to the chemistry of the elements under investigation, so as to appreciate possible sources of contamination by them, effective means of removing them, and specific tests to demonstrate their absence. The amounts of the trace elements contained in the seed become of prime importance once satisfactory control of all reagents and water has been obtained.

In reply to these views Twyman (p. 198) states that the main purpose of his communication was to direct attention to the value of the Arnon technique. While there is no doubt that molybdenum is essential to the growth of oats, it remains to be proved whether one or more of the other elements of Arnon's original B_7 group were also responsible for at least part of the response obtained in Twyman's experiment. The word 'aluminium' in Twyman's paper should read 'chromium'.

Wang (C. S.). **Studies on cytology of Ustilago crameri.** — *Phytopathology*, xxxiii, 12, pp. 1122–1133, 2 pl., 1 fig., 1943.

The mature chlamydospore of *Ustilago crameri*, the agent of millet [*Setaria italica*] smut [*R.A.M.*, xviii, p. 174], has a diploid nucleus, but each promycelial cell is usually occupied by one haploid nucleus in consequence of reduction division; the chromosome numbers of the diploid and haploid phases are four and two, respectively. Meiosis appears to occur not only in the first division, but also frequently in the second and occasionally in the third. Binucleate hyphal cells predominate in culture and in the host throughout the life-cycle until an advanced stage of chlamydospore formation, when the two haploid nuclei of opposite sex fuse, leaving one diploid nucleus. In the plant chlamydospores are produced chiefly through segmentation of the hyphal cells, whereas in culture the normal mode of formation is intercalary.

The promycelia or dicaryotic hyphae derived from chlamydospores germinating on the host function as infection hyphae, penetrating two-day-old seedlings of both resistant and susceptible varieties, apparently in the main by mechanical pressure. In susceptible varieties, such as Kaifeng No. 142, the invading hyphae develop and branch rapidly within the coleoptile cells, entering the meristematic tissue as soon as four days after germination, whereas in resistant ones, e.g. Nanking No. 31, only two out of 19 seedlings under observation were found to harbour hyphae in the meristematic region.

Blackford (F. W.). **Four major diseases of Citrus.** *Qd agric. J.*, lvii, 6, pp. 353-358, 4 figs., 1943.

The commonest disease affecting citrus in Queensland is black spot [*Phoma citricarpa*: *R.A.M.*, xx, p. 571]. All varieties may become infected, but the disease is seldom found on Washington Navel oranges and grapefruit. The next most important cause of loss of grade in citrus fruits locally is melanose [*Diaporthe citri*: loc. cit.]. All varieties may be attacked. Once the leaves and fruit are about six weeks old they become immune. Hence, as warm, showery weather and heavy dews and fogs frequently occur in Queensland coastal areas for a short period after blossoming, the disease is invariably present in these districts, though it seldom appears to any extent in the inland parts, which have a dry spring. Scab [*Sphaceloma fawcettii scabiosa*: loc. cit.] is confined to lemons and mandarin oranges, producing severe infection on rough lemon stock but rarely affecting young and well-established mandarin trees. Brown spot [*Glocosporium* sp.: loc. cit.] occurs only in the Burrum and Elimbah areas; only one citrus variety, the Emperor of Canton mandarin, is attacked, but on this infection can be very destructive. Control of all four diseases depends on orchard sanitation, good cultural methods, irrigation, and the correct timing of the spray applications.

Irrigation Research Extension Committee Report on Citrus decline on the Murrumbidgee Irrigation Areas.—13 pp., 1943.

During the past five years the health of the citrus trees grown on the Murrumbidgee Irrigation Areas of New South Wales has seriously deteriorated. A survey in the winter of 1940 revealed that on the 6,000 acres of citrus plantings, only 53 per cent. of the trees were healthy. Of the remainder, 25 per cent. were rather unhealthy, and 22 per cent. very unhealthy. Since then, the decline has become accentuated. Wet conditions in May and June, 1942, were followed by a heavy loss of trees, and almost all the groves have now become affected, many of them seriously.

The main cause of the trouble is excessive soil moisture associated with root decay due to *Phytophthora* [*citrophthora*: *R.A.M.*, xxii, p. 133]. Other causes are soil deterioration and inadequate nitrogen. Of the various contributing factors, viz., recurring wet winters, unsuitable soil, unsuitable natural surface drainage, faulty irrigation lay-out, wrong application of water, insufficient removal of surplus water, seepage in isolated cases, and difficulties in soil management, the last five may be considered controllable.

With regard to control, growers are advised, in view of the wet winters experienced, every year to prepare adequate surface drainage early in March, and, if April irrigation is necessary, to water lightly, preferably using alternate furrows or bays. Areas where frosts are experienced should not be planted to citrus. Growers should also confine themselves as far as possible to areas with suitable soil and slope conditions [which are listed]. Experience has shown that natural slopes of over 0·4 per cent. (3 in. to the chain) are highly suitable for citrus, and those of 0·2 to 0·4 per cent. fairly so, while those of under 0·2 per cent. are unsuitable.

Irrigation should be carried out only when the soil in the maximum root zone is approaching the wilting point, and only the vertical root zone should be moistened. Allowing part of the soil to dry out by alternate area watering will assist in controlling *P. citrophthora*. Directions are given for the regulation of watering, the removal of surplus water, proper soil management and culture. For replanting, [*Poncirus*] *trifoliata*, the only stock resistant to *Phytophthora citrophthora* [ibid., xxiii, p. 105], is recommended for Valencia oranges, mandarins, and grapefruit. In conclusion, emphasis is laid on the view that the removal of excess soil moisture should be the chief aim in attacking the problem.

Dunlap (A. A.). **Low light intensity and Cotton boll-shedding.**—*Science, N.S.*, xcviii, 2556, pp. 568–569, 1943.

Evidence obtained in recent studies at the Texas Agricultural Experiment Station indicates that abnormal shedding of cotton flower buds and immature bolls is often caused by interruption of two to three days in high sunlight intensities. For instance, upland cotton plants in jars of soil were subjected, two months after planting, to low daylight intensity (roughly equivalent to 50 ft. candles) by placing them in a laboratory room for a single four-day period. Five weeks later the plants thus treated each bore on an average only 5·4 good-sized bolls, and each had shed 30 buds and young bolls, while the corresponding figures for the controls were 21·2 bolls per plant and 17·5 fruiting forms shed. The low light intensity treatment was thus responsible for a reduction of 75 per cent. in the number of mature bolls. Similar increases in rates of shedding followed the shading of cotton plants in the greenhouse and field with black cloth, which reduced the direct sunlight intensity at midday from the equivalent of 12,000 to between 300 and 1,000 ft. candles.

Bertoni (A. de W.). **Enemigos y enfermedades del Algodonero.** [Pests and diseases of Cotton.]—*Agric. Com. Industr., Asunción*, i, 4, pp. 57–59, 1941. [Received November, 1943.]

The most serious disease of cotton in Uruguay is anthracnose (*Glomerella gossypii*), where other pathogens of the crop include *Bacterium* [*Xanthomonas*] *malvacearum*, wilt (*Fusarium*) [?*vasinfectum*], and the leaf spots caused by *Cercospora* [?*gossypina*] and *Ramularia* [? *areola*].

White (L. J.), Baker (A. H.), & Twort (C. C.). **Aerial disinfection.**—*Nature, Lond.*, cliii, 3874, pp. 141–142, 1944.

The authors have ascertained that cinnamic and benzoic acids are strong aerial bactericides [cf. *R.A.M.*, xix, p. 152], though citric, fumaric, maleic, malic, and phthalic acids are relatively ineffective. Maleic and phthalic anhydrides were more active than the corresponding acids. In a concentration of 4 mg. per cu. m. and a relative humidity of about 60 per cent., maleic anhydride generally sterilized the air of the test organism, *C*[*orynebacterium*] *xerosis*, in five minutes; the durability of lethal effectiveness being good, a 15-minute-old mist allowed the survival of only about 5 per cent. of the bacteria beyond the five-minute exposure time. Of 15 phenolic compounds tested, each, to sterilize or almost sterilize the air of the test organism in five minutes, required the vapour concentration to be of the order of 25 per cent. saturation. Other materials, e.g., mercuric chloride, and propylene and diethylene glycols, apparently required to be of similar concentration. Iodine and maleic anhydride were notable exceptions (below 1 per cent.).

Zobl (K. H.). **Die Morphologie und Biologie der bei Vaginalmykosen gefundenen Sprosspilze.** [The morphology and biology of the yeasts encountered in vaginal mycoses.]—*Arch. Hyg., Berl.*, cxxx, 5–6, pp. 205–237, 6 figs., 1943.

A full description is given of the author's cultural and mycological studies at the Institute of Hygiene, University of Würzburg, on the 24 isolates of *Candida albicans*, 11 of *C. tropicalis*, 4 of *C. parapsilosis* [*C. parakrusei* fide Langeron & Guerra: *R.A.M.*, xviii, p. 253], and 1 of *Sporotrichum beurmanni* var. *asteroides* encountered in 24 cases of vaginal mycosis. Special attention was given to the taxonomy of the yeast-like fungi, the major contributions to the literature on which are critically discussed. The three *C.* spp. are relegated to the family Torulopsidaceae, subfamily Mycotoruloideae.

The solid substrata used for the culture of the fungi included beer wort, carrot, and Gorodkowa's agar and Clauberg plates, and the liquid media Raulin's, alcohol, milk, and litmus-peptone-sugar solution. The best macroscopic criterion for the

differentiation of *C. albicans* from *C. tropicalis* and *C. parakrusei* is the mode of pseudomycelial growth on solid media, which in the first-named is entirely submerged in younger cultures and seldom rises above the surface of the agar even in older ones (three to four months). The edge of the culture is therefore defined in the case of *C. albicans*, in contrast to the two other species, in which the pseudomycelium appears on the surface of the agar at an early stage. Microscopic examination of the cultures revealed an amazing diversity of forms, readily accounting for the number of descriptions of *C. albicans* as a new species. All stages of development, moreover, may be represented in each individual isolate of a given strain, from pure budding cells (the yeast growth form) to well-developed, cylindrically elongated, concatenate cells (pseudomycelia), one or another phase predominating according to the consistency and hydrogen-ion concentration of the medium, and (to a lesser extent) differences in temperature. A further complication is introduced by the occasional formation of hyphae with septation and true branching, especially where the supply of oxygen is reduced and that of carbon dioxide increased. Both on solid and liquid substrata the yeast growth form occurs principally in young cultures. The globose cells measure 3 to 6 or 8 μ in diameter, the oval 6·5 by 4, 8 by 6, or 12 by 6 μ, and the elongated 15 to 17 or 20 by 3·5 to 4·5 μ. The initially hyaline cell content later becomes strongly refringent, the enclosures staining black with osmic acid and including vacuoles, sometimes a particularly large one. Germination or budding is usually uni-, more rarely bipolar, while 'crown formation' ('Kronenbildung') may also be observed.

The pseudomycelial growth form of *C. albicans*, which was particularly prominent in alcohol and on carrot slices and carrot agar, arises from the continuous budding of a single cell, mostly in one and the same direction, the elongated cells remaining loosely united and presenting a dendriform appearance. On solid media the pseudomycelium extends deeply downwards in the shape of dense, fringed strands, simulating a rootstock. At the junction between two of the elongated cells arise the typical blastospore groups resembling blackberries, while occasional 'blastoconidia' were also observed developing laterally from the elongated cells and sometimes bearing blastospore groups at their tips. A peculiar mode of growth frequently occurs, which led to the erection by Ota of the genus *Blastodendrion* [ibid., viii, p. 677]: the few blastospores produced develop longitudinally and bear at their tips a fresh crop of 'blastoconidia'. Chains of buds, which the author considers to be reminiscent of *Catenularia* and *Scopulariopsis*, may likewise be present. As mentioned above, septate, sparsely branched true hyphae may be formed by the longitudinal extension of a bud, thereby giving rise to confusion with a Hyphomycete or the transitional genus *Trichosporum*. The large, round chlamydospores develop for the most part terminally, but may be produced on any portion of the pseudomycelium. Ascus formation was not observed.

C. albicans fermented glucose, fructose, mannose, maltose, and galactose, the last-named very weakly. Peptone, asparagin, and ammonium sulphate were utilized as sources of nitrogen. Gelatine was slowly liquefied. The fungus made equally good growth at 18°, 22°, 37°, and 45° C., apart from a slight initial delay at the last-named temperature. The thermal death point was 56° (20 minutes' exposure).

C. tropicalis is readily distinguishable from *C. albicans* on beer wort agar by its rugose surface and more or less abundant aerial pseudomycelium. The colour and consistency of the colonies are very similar to those of *C. albicans* and on most of the other substrata used the differences are not perceptible. *C. tropicalis* is also characterized by multifarious modes of growth, a single monospore culture, for instance, producing all manner of transitional stages between globose cells, 2 to 10 or 20 μ in diameter, oval to cylindrical, 5 to 12 by 3 to 4 μ, and elongated, 10 to 40 by 1 to 8 μ, the last-named sometimes being provided with transverse septa like true hyphae.

Pseudomycelium is formed most conspicuously on milk, carrots, and alcohol, particularly characteristic being the concatenate 'blastoconidia' of the *Scopulariopsis* type. Blastospore groups and occasional hyphae, as in *C. albicans*, are also produced. In contradistinction to Windisch [ibid., xx, p. 382], the author detected very few chlamydospores, and he interprets the supposed occurrence of these organs and asci in *C. albicans* and *C. tropicalis* as resting on confusion with the development of 'crowns' from old round cells.

C. tropicalis fermented glucose, fructose, mannose, maltose, saccharose, and glucose. Peptone, asparagin, and ammonium sulphate were utilized as sources of nitrogen. The temperature relations were similar to those obtaining in the case of *C. albicans*.

C. parakrusei forms on beer wort agar smooth, dully lustrous, whitish, later yellowish colonies, the periphery being surrounded by pseudomycelium, the aerial growth of which, however, is less abundant than in *C. tropicalis*. On Gorodkowa's agar the pseudomycelium develops into thick, plaited strands extending downwards into the substratum. The absence of a pellicle on alcohol serves to differentiate *C. parakrusei* from *C. krusei*.

The round, oval, and elongated cells of *C. parakrusei* measure, respectively, 2 to 4 μ in diameter, 4 to 8 by 3 to 6 μ, and 5 to 20 by 2 to 5 μ; giant round cells with a double membrane are also of frequent occurrence. 'Crown formation' was observed in a number of cultures. The well-developed pseudomycelium is predominantly of the *Mycocandida* type, as described by Langeron and Talice [ibid., xi, p. 476]. A peculiar feature is the regular arrangement of the elongated cells, giving the appearance of a monopodial branching system. 'Blastoconidia' are produced, but in smaller numbers than by *C. tropicalis*. A further differential character of *C. parakrusei* is the dimorphism due to the presence of giant cells within the pseudomycelium. Hyphal formation is occasionally simulated by the occurrence of long, filiform, budding cells. The only organs bearing any resemblance to chlamydospores were round cells with double membranes in old cultures, and the ascogenous stage failed to develop.

Glucose, fructose, mannose, maltose, and galactose were fermented to a moderate extent by *C. parakrusei*. Peptone, asparagin, ammonium sulphate, and urea were utilized as sources of nitrogen, the last-named weakly. Like *C. albicans* and *C. tropicalis*, *C. parakrusei* made equally satisfactory growth at a temperature range of 18° to 45°.

Chilton (St. J. P.), Bain (D. C.), & Person (L. H.). **Effect of seed treatments on stands of ornamental plants.** Abs. in *Proc. La Acad. Sci.*, vii, p. 36, 1943.

Seed treatments of *Calendula*, *Salvia*, snapdragon [*Antirrhinum majus*], *Centaurea*, *Zinnia*, *Cosmos*, and pansy [*Viola tricolor*] with various commercial products recommended as increasing stands by reducing damping-off showed that the best results were given by cuprocide and yellow copper oxide, which increased the stands by 400 per cent. Vasco 4 was almost as effective as cuprocide, while spergon increased stands, but was less efficient than cuprocide or yellow copper oxide in reducing post-emergence damping-off. New improved ceresan, ceresan, and new improved semesan frequently proved toxic.

Mader (E. O.). **Effect of mineral nutrition on flower production of own-rooted Roses and the incidence of black-spot.**—*Phytopathology*, xxxiii, 12, pp. 1185–1189, 1943.

In connexion with an experiment in 1938-9 designed to determine the effect of two nutrient solutions of varying composition on flower production, 'blindness', and 'bullhead' formation (incomplete flower development) in five rose varieties, it was observed that the incidence of black spot [*Diplocarpon rosae*] was much

higher in plants grown in solution Withrow E 2, consisting of 6 per cent. potassium sulphate, 0·5 per cent. tetrahydrogen calcium phosphate, 4 per cent. each of calcium nitrate and ammonium nitrate, and 0·5 per cent. magnesium sulphate, than in Mader R–1, in which potassium sulphate was replaced by potassium nitrate and the other ingredients supplied at the rates of 2, 5·3, 8, and 4 per cent., respectively; each solution received weekly additions of 7·5 p.p.m. iron and 0·5 p.p.m. boron, 0·05 p.p.m. of copper and the same quantity of zinc, and 1 p.p.m. manganese at three-weekly intervals and was applied to the roses at a dosage of 100 gals. per 66 sq. ft. For instance, the average numbers per plant of healthy and diseased leaflets on the Briarcliff, Better Times, Johanna Hill, Ellen, and Hollywood varieties grown in Withrow E 2 were 287 and 131, 352 and 136, 293 and 193, 382 and 185, and 294 and 158, respectively, the corresponding counts for Mader R-1 being 373 and 29, 441 and 22, 354 and 53, 517 and 29, and 371 and 24, respectively.

The plants grown in the potassium sulphate solution also exhibited a different pattern from that on the potassium nitrate series, the lesions on the former being greyish, with radiating margins, giving them a feathery appearance; ultimately they turned black and assumed a roughly circular form, 1 to 2 cm. in diameter. On the other hand, the spots on the plants in the latter solution were generally minute (mere pin-points in some cases), circular, sharply defined, black, and altogether suggestive of arrested infection. The comparatively mild attack of black spot on the plants in the Mader R 1 solution was correlated with vigorous growth, luxuriant flower production, and a tendency to 'bullhead' formation.

The results of outdoor experiments in 1942, using a modified Mader R-1 solution at the rate of 100 gals. per 528 sq. ft., appeared to confirm the laboratory observations as to the efficacy of this treatment in the prevention of black spot, which infected only 157 leaves on a total of 540 plants, but further studies are necessary to differentiate between the effect of garden sites and mineral nutrition on the control of the disease.

Darke (J. E.). **Chrysanthemum cultivation.** *Fruitgrower*, xcvi, 2496, pp. 288, 293, 1943.

Verticillium wilt is stated to be the most prevalent and devastating disease of chrysanthemums in England, where it was scarcely known, however, 30 years ago. Some 50 per cent. of all the varieties grown are affected, including some of the most popular, such as the Framfields (represented by the well-known Winter Cheer), Wallaces, Favourites, Balcombs, Precoses, and Consuls. Rust [*Puccinia chrysanthemi*] has been little in evidence of recent years, and spotted wilt has so far caused no serious damage, the Coralie variety being the only one observed by the writer to be affected. White mildew [*Oidium chrysanthemi*] is readily controllable by an occasional application of high-grade sulphur dust.

Olive (L. S.). **Thekopsora hydrangeae.** *Mycologia*, xxxv, 6, p. 655, 1943.

In this note the author makes two minor corrections to his recent paper on *Thekopsora hydrangeae* [*R.A.M.*, xxii, p. 434].

Streets (R. B.). **Diseases of the Rose in Arizona.** *Bull. Ariz. agric. Exp. Sta.* 190, 25 pp., 6 pl., 1943.

This bulletin provides a key for the identification of diseases of roses in Arizona and gives short descriptions with recommendations for their control. Of major importance in the State are Texas root rot (*Phymatotrichum omnivorum*), crown gall (*Phytomonas* [*Bacterium*] *tumefaciens*), hairy root (*P.* [*Bact.*] *rhizogenes*), powdery mildew (*Sphaerotheca pannosa* var. *rosae*), to which the climbing varieties Cecile Brunner, Red Radiance, Golden Emblem, American Beauty, and Hoosier

Beauty are fairly resistant, and chlorosis, mainly due to lack of available iron. Two little studied diseases are root rot, characterized by the sudden death of the root system followed by a drying of the top, the cause of which is as yet unknown, and die-back, mainly a physiological disorder influenced by various factors lowering the vitality of the plant. Several diseases not hitherto recorded in Arizona, or only rarely, are discussed briefly, and notes are also given on [unspecified] virus diseases, of which one has been found on a few plants recently imported from another State; prompt eradication of diseased bushes is recommended as the only means of control of virus diseases.

Groves (A. B.), Miller (H. J.), & Taylor (C. F.). **Tri-state Cherry-spray investigations.**—*Bull. Pa agric. exp. Sta.* 447, 26 pp., 1943.

In this bulletin (which is also printed without change in text or authorship as Bulletin 354 of the Virginia Agricultural Station and Bulletin 310 of the West Virginia Agricultural Station), a full report is given of three years' co-operative investigations carried out in Pennsylvania, West Virginia, and Virginia to devise a satisfactory spray schedule against cherry leaf spot (*Coccomyces hiemalis*) [*R.A.M.*, xxi, p. 148].

The data obtained showed that liquid lime-sulphur failed to control late-season leaf-spot infection with subsequent defoliation, though it gave good control early in the season, when the foliage was developing rapidly, the fruit was quite tender, and the amount of inoculum small. As the fruit approached maturity, however, it became susceptible to sulphur sun scald, and this condition was aggravated by higher temperatures. When removal of the field boxes to the processing plant was delayed, the treated fruit also tended to scald. The increased danger of foliage injury after picking and the failure to control infection made the late-season use of lime-sulphur even more risky.

Bordeaux mixture gave good control both early and late in the season, but frequently reduced fruit size and increased the sugar-content relatively and absolutely. Several proprietary copper compounds gave satisfactory control, but caused fruit injury. The organic fungicides tested were, with one exception, unsatisfactory, and may have retarded fruit development. The leaves of all copper-sprayed plots showed injury, appearing as brown flecks and eventually covering most of the lower surface, accompanied by a tendency to curl upward. A characteristic stem-end or copper-ring injury developed as a black line on the fruit at the base of the stem yet separated from it by a ring of normal tissue. It was less frequent with Bordeaux than with the proprietary coppers tested.

The evidence indicated that best results are likely to follow the adoption of a split schedule. Early season applications of lime-sulphur are suggested, followed by Bordeaux mixture. One schedule tested consisted of two lime-sulphur (2 in 100 gals.) plus 3 lb. lime at petal-fall and 'shuck' stages, respectively, and two Bordeaux (2–4–100) sprays, the first Bordeaux application being made at the first cover spray (about three weeks after the 'shuck' spray) and the second as a post-harvest spray applied soon after picking. The authors consider that a similar schedule with the second Bordeaux spray shifted to pre-harvest would probably not be objectionable where the fruit is to be processed in a commercial plant, but objection would be taken to visible residue on fruit sold as fresh fruit.

Sharvelle (E. G.) & Chen (S. M.). **Cultural variation in single ascospore isolates of Sclerotinia fructicola (Wint.) Rehm from Cherry Plum hybrids.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1118, 1943.

Attempts to isolate complete sets of ascospores from single asci of *Sclerotinia fructicola* from cherry-plum hybrids failed until the conditions influencing the discharge of these organs were ascertained. The process was found to be stimulated

by the maintenance of the asci at 15° C. for four to ten hours, followed by transference to room temperature for two. Sixteen lines derived from two asci fell into four distinct groups on the basis of cultural characters, sensitivity to sulphur fungicides, and pathogenicity on apple fruits.

Jenkins (Anna E.) & Shear (C. L.). **Gloeosporium venetum and G. necator : two distinct species.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1115, 1943.

The examination of authentic material of *Gloeosporium venetum* Speg., described from Italy in 1879, showed that the fungus is not Melanconiaceous but pycnidial in nature, while the host appears to be *Rubus fruticosus* and is in any case not *R. chamaemorus*, as originally reported. None of the Sphaeropsidaceae agrees in its entirety with *G. venetum*, though the foliicolous *Phyllosticta fuscozonata* Thuem. presents certain analogies with it. A recent study of *G. necator*, described by Ellis and Everhart in 1887 as the agent of destructive stem cankers on black and red raspberries, and supposed by Scribner (1888) to be identical with *G. venetum*, clearly showed the former to be a species of *Sphaceloma* (Melanconiaceae). The separation of *G. necator* (the perfect stage of which is *Elsinoe veneta*) from the less familiar *G. venetum* proves that the earliest records of *Rubus* anthracnose originated in North America and not, as formerly supposed, in Europe, where it was admitted by Arnaud and Mme Arnaud in 1931 to be infrequent.

Godfrey (G. H.) & Young (P. A.). **Soil fumigation for plant disease control.**—*Bull. Tex. agric. Exp. Sta.* 628, 40 pp., 9 figs., 1943.

In experiments in Texas on soil fumigation against plant diseases soil was placed in containers of 2 cu. ft. capacity and various chemicals were injected at two depths, equidistant from each other and from the top and bottom. The drums were then sealed with glue-coated draft duplex paper. The covers were generally removed four days after treatment, the soil then being ventilated for two or three days. Soil samples were next put into pots in which tomato plants started in sterilized soil were then planted. When dry sclerotia of *Sclerotium rolfsii* enclosed in cheesecloth bags were introduced into the containers, the lethal dosage of ethylene dichloride was over 2,000 lb. per acre, and the same for carbon disulphide, while at 500 lb. per acre of chloropicrin one sclerotium survived in one of two treated drums. The sclerotia of the fungus were also killed by treatment of the soil with methyl bromide at the rate of 2½ ml. per cu. ft. (400 lb. per acre). In an outdoor test beds in which a year before Dutch bulbous iris had shown approximately 50 per cent. loss from *S. rolfsii* were fumigated with chloropicrin at 500 lb. per acre by standard methods, and planted to Wedgwood iris. Only five out of 780 plants became infected, and these were all growing at the margins where the soil had been wetted for gas confinement at the time of fumigation. In a comparable non-fumigated bed 42 of 127 iris plants (33 per cent.) were killed by infection.

In experiments on the control of damping-off of tomato seedlings (chiefly *Pythium* and *Rhizoctonia* [*Corticium*] spp.) treatment was carried out on soil (25 lb.) in metal trays. The best control was given by chloropicrin (average for three years, 61 per cent. emergence and 6·6 per cent. seedlings lost from post-emergence damping-off, as against 26·6 per cent. emergence and 38 per cent. lost for the untreated controls). Carbon disulphide (one year's test) gave 51 per cent. emergence and 50 per cent. post-emergence loss. Formaldehyde gave excellent results in one year, but killed most of the seeds in the next. Semesan and cuprocide were valuable in decreasing post-emergence loss.

Taking the results of the work as a whole, the authors conclude that tomato wilt (*Fusarium* [*bulbigenum* var.] *lycopersici*), southern blight (*S. rolfsii*), and damping-off (mainly *P.* and *C.* spp.) were generally controlled by soil fumigation with chloropicrin at rates of 2·5 to 4 ml. per cu. ft. (400 to 600 lb. per acre). Detailed

directions are given for applying the fumigation method of soil sterilization, and there is a bibliography of 74 titles.

Frear (D. E. H.). **A catalogue of insecticides and fungicides.**—*Science*, N.S., xcviii, 2557, p. 585, 1943.

The author has compiled a catalogue of approximately 5,000 individual insecticidal and fungicidal materials mentioned in over 500 literature citations as having been submitted to test for their insecticidal or fungicidal properties. Workers are invited to communicate any unpublished data, reprints, or citations dealing with insecticidal or fungicidal tests. In particular, lists of materials tested by industrial research laboratories would be welcomed, even if the results obtained were negative. It is intended to issue the catalogue as soon as possible, and every bona fide contributor is assured of a copy.

Thomas (C. A.). **The effect of some commercial fungicide dust fillers on plant growth.**—*Proc. La Acad. Sci.*, vii, pp. 16–17, 1943.

In tests made to ascertain the effect upon plant growth of diluents used in copper fungicides, peas and beans germinated in a filtrate containing one part bentonite clay in 50 parts water showed toxic effects, these being apparent in a brown discoloration of the roots. Peas grown directly in bentonite were stunted, and became wilted in ten days, whereas others grown in magnesia talc and pyrax were identical in size and colour with peas grown in washed sand. When magnesia talc and pyrax were applied to clover plants in the greenhouse no toxic effects followed.

Yarwood (C. E.). **The function of lime and host leaves in the action of Bordeaux mixture.**—*Phytopathology*, xxxiii, 12, pp. 1146–1156, 4 graphs, 1943.

Sprays composed of lime alone, bluestone [copper sulphate] alone, and mixtures of both ingredients (Bordeaux) were compared for their inhibitory action on the germination of bean rust (*Uromyces phaseoli*) [*U. appendiculatus*] uredospores and cucumber downy mildew [*Pseudoperonospora cubensis*] sporangia, for the protection of Pinto beans and Long Green cucumber plants against these diseases, and for the eradication of established infections of bean powdery mildew (*Erysiphe polygoni*) at a range of dosages from below 50 to above 95 per cent. control.

To obtain 95 per cent. inhibition of germination of *U. appendiculatus* uredospores on glass, it was necessary to use 300 mg. per sq. dm. calcium oxide, 0·60 mg. copper as copper sulphate, or 64 mg. copper as Bordeaux, the corresponding amounts required for a 95 per cent. reduction in the number of rust pustules on plants being 124, 2·6, and 0·18 mg., respectively. For equivalent effectiveness it required about 100 times as much copper in the form of Bordeaux mixture as in the form of copper sulphate in tests on glass slides and about 10 times as much bluestone as Bordeaux in tests on leaves. With Bordeaux 350 times as much spray was required when the tests were on slides as when on leaves. In similar tests with *P. cubensis*, 95 per cent. reduction in germination on glass was secured by 113 mg. per sq. dm. calcium oxide, 0·049 mg. copper as copper sulphate, or 0·060 mg. copper as Bordeaux, the corresponding amounts required for equivalent protection on plants being 122, 2·2, and 1·7 mg., respectively. The addition of 0·05 per cent. phthalic glyceryl alkyd resin as a spreader decreased the quantity of fungicide required for control of *P. cubensis* to 27, 20, and 2 per cent. for lime, copper sulphate, and Bordeaux, respectively.

Bean leaves sprayed with 0·1 per cent. copper sulphate and held in a moist chamber for four hours were shown by chemical determination to retain only 43 per cent. copper on the leaf surfaces, and the control of rust was greatly reduced by exposure to such conditions, which did not, however, adversely affect Bordeaux-treated plants. The addition to copper sulphate solutions of increasing amounts of lime progressively enhanced the protective action of the mixtures against *U. appendicu-*

latus, but at the same time their value as eradicants of bean rust and powdery mildew underwent a steady decline. The optimum copper : lime ratio for the control of these diseases is probably of the order of 1 : 1. It is concluded that an important function of lime in Bordeaux mixture is to hold the copper in a form relatively unavailable and non-toxic to the plant, but toxic to pathogenic fungi.

In the light of these data it may be necessary to revise current methods for the application of *in vitro* toxicity to the evaluation of fungicides, which may be largely invalidated if many fungi are found to react similarly to *U. appendiculatus*.

Hooper (I. R.), Anderson (H. W.), Skell (P.), & Carter (H. E.). **The identity of clavacin with patulin.**—*Science*, N.S., cxix, 2558, p. 16, 1944.

From a study of the properties of clavacin [see above, p. 168] obtained from *Aspergillus clavatus* (No. 129) the authors conclude it is identical with patulin, isolated from *Penicillium patulum* [*R.A.M.*, xxiii, p. 117 and next abstract].

Florey (H. W.), Jennings (M. A.), & Philpot (Flora J.). **Claviformin from Aspergillus giganteus Wehm.**—*Nature, Lond.*, cliii, 3874, p. 139, 1944.

Aspergillus giganteus, already known to produce a penicillin-like substance, was found to produce also an antibiotic apparently identical with claviformin. The antibiotic 'patulin', isolated from culture filtrates of *Penicillium patulum* [see preceding abstract] is also known to be identical with claviformin, as is the antibiotic isolated by Wiesner from culture filtrates of *Aspergillus clavatus* [*R.A.M.*, xxi, p. 283].

Stock (E.). **Mold (resistant paints).**—*Farbenztg*, xlii, pp. 283-285, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 22, p. 6910, 1943.]

Paint moulds require water, food, a temperature of 25° to 40° C., and a hydrogen-ion concentration of $P_H 2$ to 9. The most resistant paints are those producing a hard, impervious film in the shortest drying time. Water-soluble organic binders provide nutriment for the moulds, but inorganic compounds, especially the silicates, are useful, as they dry rapidly to a hard, water-resistant, alkaline film which will not support fungal growth. A high ratio of pigment to binder is always desirable. In oil-base paints lead and zinc pigments neutralize acidity and form soaps with some fungicidal effect: zinc oxide is recommended for this purpose. The addition of organic fungicides to the coating is useful, but inorganic compounds such as mercuric chloride involve grave risks of poison. A high resin content is helpful, the phenolics being particularly valuable, while the oil-rich alkyds should be avoided. Chlorinated rubber yields an exceptionally good anti-mould film, permitting frequent scouring with chemicals. Pre-treatment of the surface to be coated to remove existing mould growths is important.

Dunnicliff (H. B.) & Padwick (G. W.). **Biological examination of some Indian hide curing salts.**—*J. Indian chem. Soc.*, Industr. & News Ed., vi, 1, pp. 4-22, 1943.

A fully documented and tabulated account is given of the authors' microbiological analyses in 1942 of 26 samples of salts to determine their applicability to the curing of Indian hides. About 45 per cent. of all hides produced in India are salted, but owing to the scarcity or unavailability of inedible materials, alimentary salt is used for this purpose. In view of the increasing importance of the leather industry at the present juncture, the problem of suitable treatment of hides has become acute, and it was suggested that impure bitterns salts, i.e., the crop deposited after the purest sodium chloride has crystallized out, should be tested, primarily for their bacteriological content in connexion with the defect known as 'red heat'. A number of the samples yielded *Aspergillus* spp. in culture, but the conclusion is

reached that manufactured Sambhar Lake (Rajputana) 'bitterns' salt is serviceable for the curing and pickling of hides either for home use or export.

Resistance of textiles to micro-organisms.—*Canad. Chem. Process Ind.*, xxvii, 8, pp. 480–481, 1943.

The alternative methods of testing textiles for resistance to micro-organisms, viz., accelerated mildew infection and soil burial [*R.A.M.*, xxii, p. 396; xxiii, p. 116] here outlined are contained in Supplement No. 1 to the Schedule of Methods of Testing Textiles, issued by the Canadian Government Purchasing Standards Committee on 8th June, 1943. The accelerated mildew infection procedure is applicable chiefly to fabrics of the canvas and duck types designed for use in humid atmospheres, and soil burial to sandbags and other materials likely to be in contact with damp soil for lengthy periods. *Chaetomium globosum* is used as the test fungus in both methods.

Jensen (L. B.). **Microbiology of meats.**—xi—252 pp., 1 col. fig., 2 diags., 5 graphs, Champaign, Ill., The Garrard Press, 1942. $4.00.

Of special interest in this up-to-date, fully documented survey of available information concerning the microbiology of meat are chapters X and XI, the former dealing with the control of micro-organisms, e.g., by technical sanitation, storage in carbon dioxide, and intermittent steam sterilization, and with various methods of testing and analysis, and the latter discussing the microbiology of spices, salt, sugar, paper, and wood. In this connexion it may be noted that the mould content of some supposedly preservative spices (untreated) can be very high, especially Italian, ground black, and red peppers. Another source of pollution is the sawdust on packing, shipping, and hanging floors and the like; after three weeks the number of mould fungi in untreated sawdust on cooler floors was 819,000 per gm. compared with 50 in sawdust treated in a kiln at 180° F. for three hours and sprayed with phenyl mercuric nitrate solution (1 in 500,000).

Andersen (A. A.). **Recovery of agar from used media.**—*J. Bact.*, xlvi, 4, pp. 396–397, 1943.

Details are given of a simple and satisfactory method for the recovery of agar from used culture media developed at the Western Regional Research Laboratory, Albany, California. The sterilized medium is collected from time to time, dried, ground, washed in tap water until the soluble matter is removed, and dried ready for use. The reclaimed agar is treated with 10 gm. activated charcoal per l. before filtering when being used again.

Blackwell (Elizabeth). **Presidential address. On germinating the oospores of Phytophthora cactorum.**—*Trans. Brit. mycol. Soc.*, xxvi, 3–4, pp. 93–103, 1943.

The oospores of *Phytophthora* are stated to be peculiarly resistant to germination, there being only about a dozen definite records since de Bary's in 1866. Dormant oospores of *P. cactorum*, the object of the author's special study [*R.A.M.*, xxii, p. 455], are described as colourless and transparent, perfectly spherical, and lying loosely within the colourless oogonial wall, being smallest at the height of the dormant state. The homogeneous protoplasm is enclosed within a thin, transparent outer oospore wall and a thick, transparent inner one. Within the protoplasm are lodged one excentric refringent globule, which turns brown in osmic acid and is probably of highly saturated fat, and a small and yet more highly refringent body, containing the nucleus and perhaps a plastid, which turns black in osmic acid. Oospores in which the protoplasm can no longer be discerned and appearing glassy are dead. Those preparing for germination are larger (almost filling the oogonial cavity), active, thin-walled, and the protoplasm in them is more abundant, with

the appearance of a uniform emulsion occupied by several refringent globules, among which the nucleus is not readily distinguished. As a result of much experimentation the following recommendations are made for germinating the oospores of *P. cactorum*: provided the oospores are well-formed and normal, one month or more should be allowed for full maturation at 10° to 15° C. in a moist atmosphere, followed by one to eight months of dormancy under similar conditions; the cultures are then refrigerated at a temperature just above freezing point for a week or two, soaked in tap water of P_H 8·0 and a calcium content of 19 parts in 100,000 or in a soil solution of P_H 7·0 and a calcium content of 15 in 100,000, changing the solution daily if possible. Germination occurs one to three or more weeks later, but never do all the spores germinate at the same time. The author discusses at length the nature of dormancy in oospores and the factors concerned in their germination.

Drew (J. P.) & Deasy (D.). **Losses in Potatoes during storage.** *J. Dep. Agric. Eire*, xl, 2, pp. 306–314, 1943.

Recommendations are made for reducing losses in stored potatoes. In an investigation extending over two years evidence was obtained that careful selection of potatoes for storing is requisite to avoid losses from decay: that access of water to the pits greatly increased the loss; and that extensive sprouting took place after February, from which month potatoes should be examined at intervals and all sprouts and diseased tubers removed.

Helson (G. A. H.) & Norris (D. O.). **Transmission of Potato virus diseases. 3. Susceptibility of Cruciferae to Potato leaf roll virus.** *J. Coun. sci. industr. Res. Aust.*, xvi, 4, pp. 261–262, 1943.

Attempts to transmit potato leaf-roll virus to a number of cruciferous plants and to the peach by means of grafting and the use of *Myzus persicae* gave negative results.

Dykstra (T. P.) & Du Buy (H. G.). **Preserving plant viruses in vitro by means of a simplified lyophile apparatus.** *Science*, N.S., xcvi, 2486, pp. 189–190, 1 diag., 1942.

A method is described for preserving the longevity of plant virus preparations by the use of a modified lyophile apparatus, in which the plant juice containing virus is dehydrated by a combination of evacuation, condensation, and chemical drying. The two viruses used were potato virus Y and that of Canada streak [potato aucuba mosaic virus], which when extracted in air remain viable at 15° C. for about 72 and 120 hours, respectively. In the present study the two viruses were extracted in carbon dioxide and, after being dehydrated in the lyophile apparatus, continued to produce 100 per cent. infection for as long as four months.

Rieman (G. H.) & McFarlane (J. S.). **The resistance of the Sebago variety to yellow dwarf.**—*Amer. Potato J.*, xx, 10, pp. 277–283, 1943.

In field tests conducted in 1941 and 1942 on 19 farms in the yellow dwarf [*R.A.M.*, xxii, p. 399] potato area of central Wisconsin, representing a wide range of growing conditions, only 0·5 per cent. of plants of the variety Sebago on all farms became infected, whereas approximately 18 per cent. of those of the variety Russet Rural were diseased. The results clearly indicated that the variety Sebago, though apparently very resistant to yellow dwarf, is not immune, showing 0 to 2 per cent. (average 0·5 per cent.) infection. The symptoms on the infected Sebago plants were as distinctive as on Russet Rural, indicating that once infection occurs, the progress and behaviour of the disease is comparable in both varieties. It is suggested that the low incidence of yellow dwarf in the Sebago variety may be due to the avoidance of that variety by the vectors. High agreement was found to

exist between yellow dwarf expression in the field and in the greenhouse. It is considered that by carefully controlling temperature relationships, more consistent results may be expected in the greenhouse than in the field.

The F_1 population of a cross between Sebago and the susceptible variety Hindenburg showed 7 per cent. yellow dwarf as compared with 40 per cent. in the variety Russet Rural, indicating that yellow dwarf resistance may possibly be inherited.

Köhler (E.). **Untersuchungen über das K-Virus der Kartoffel. 2 Mittlg.** [Studies on the K-virus of the Potato. Note 2.]—*Angew. Bot.*, xxv, 1–2, pp. 13–23, 6 figs., 1943.

Continuing his studies on the K-virus of the potato [*R.A.M.*, xxi, p. 500], the writer carried out a series of experiments on the transmission of the disease by means of viruliferous aphids (*Myzus persicae*), which were applied to halved tubers of the Jubel, Stärkereiche [Starchy], and Juli varieties before planting them in pots, the inoculum being derived from a second-year Altgold plant. Six out of ten Jubel plants arising from the inoculated tubers showed uniform symptoms, consisting of a more or less pronounced crinkle mosaic of the apical leaves, accompanied by a necrotic stippling, and in some cases by necrotic streaks on the stem. Samsun tobacco plants, inoculated with juice from the diseased Jubel potatoes, contracted the symptoms associated with the X-virus, thereby confirming previous observations as to the latency of the latter in this variety. In the following year (1942) the progeny of all the Jubel plants which had shown unmistakable symptoms of infection by the K-virus developed the typical features of a powerful X+A infection. In the case of Starchy no symptoms became apparent during the year of inoculation, but the progeny of five out of ten plants developed mild mosaic, and a sixth showed the typical severe symptoms; the latter was the only one, as shown by juice transmission tests on Samsun, to contain the X-virus, the combination of which with K induces a well-marked mosaic of tobacco leaves. The inoculated plants of the Juli variety and their offspring exhibited complete immunity from infection.

Another series of aphid transmission tests was conducted to establish the assumption, based on the results of previous investigations, that the leaf-rolling mosaic of the small-leaved Wohltmann variety is caused by virus K. Out of one lot of 15 plants, at least seven yielded definite evidence of transmission, while another two developed an unfamiliar type of infection, termed '*aurea*', details of which are reserved for publication elsewhere. In a second batch of 15 plants only three reacted positively; in two of these the symptoms were aberrant, and in the third leaf roll was already present, resulting in a mixture of symptoms.

Of 15 young plants—five each of Jubel, Parnassia, and Wohltmann—inoculated by rubbing the leaves with K-virus juice from Ackersegen, only two of the last-named variety responded positively. The virus was similarly transmitted to *Solanum ajuscoense*, *S. antipoviczii*, and *S. demissum* and its var. *xitlense*. *S. demissum* would appear to be particularly well adapted for experimental purposes.

Allen (L. A.). **Spore-forming bacteria causing soft rot of Potato and retting of Flax.**—*Nature, Lond.*, cliii, 3877, pp. 224–225, 1944.

Samples of retting liquor and flax taken at various stages during different processes of retting were submitted to bacteriological examination, and it was ascertained that at or near the completion of the retting soft rot of potato was consistently produced by high dilutions of the liquor or of the flax extract. Bacteria causing soft rot of turnip were also consistently present.

The evidence showed that ability to cause potato soft rot was restricted to spore-bearing bacteria. Anaerobic spore-bearers usually predominated among the causal organisms, but aerobic spore-bearers were sometimes present in appreciable numbers. From two different rets *B[acillus] subtilis* was isolated in pure culture.

From each strain an enzyme powder was prepared, capable of acting in the presence of an antiseptic inhibiting bacterial growth. These enzymes were found to rot potato and ret flax. The fact that retting in tanks on a large scale is accompanied by the growth of large numbers of spore-forming bacteria which produce potato soft rot suggests that they may also be responsible for the retting.

Hoffmaster (D. E.), McLaughlin (J. H.), Ray (W. W.), & Chester (K. S.). **The problem of dry rot caused by Macrophomina phaseoli (= Sclerotium bataticola).**—Abs. in *Phytopathology*, xxxiii, 12, pp. 1113–1114, 1943.

'Charcoal rot' (*Macrophomina phaseoli*) of maize [*R.A.M.*, xxii, p. 384], sorghum, potatoes, beans, cowpeas, and groundnuts is a major pathological and economic problem in the southern United States, where the losses may amount to 48 per cent. in maize and 5 to 75 per cent. in potatoes. New hosts of the pathogen are *Catalpa*, cedar, lucerne, and broom corn [sorghum]. The fungus is chiefly injurious to seedlings and immature plants devitalized by environmental extremes, wounds, or infection by other organisms, its effects including damping-off, stem rot, precocious ripening, low yields, and premature death. *M. phaseoli* flourishes at high temperatures. Single conidia invariably produce the sclerotial stage of the fungus, and it is suggested that the sclerotia may be immature pycnidia. Tentative proposals for control, based on the improvement of crop health and vigour through cultural practices, include the liming of soil (for sorghum), increasing the organic content of the soil, and the use of resistant varieties.

Watson (R. D.). **Charcoal rot of Irish Potatoes.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1120, 1943.

Tuber rot of potatoes (*Sclerotium bataticola*) [*Macrophomina phaseoli*: see preceding abstract] was very severe in eastern Texas in 1943, causing losses of 15 to 20 or up to over 50 per cent. of the crop in the ground or in storage. The fungus frequently enters the tuber through the stolon end, while the eyes and enlarged lenticels also serve as channels of infection. The embedded sclerotia impart an ashen-grey tinge to the stolon, while diseased tubers develop a somewhat flaccid, watery, usually superficial, black rot. Secondary infections, e.g., by *Erwinia carotovora* and *Fusarium* sp., are of common occurrence, but in their occasional absence the tubers invaded by *M. phaseoli* eventually acquire a leathery consistency and undergo mummification. The chief factors in an epiphytotic are high temperatures and high soil moisture.

Harvey (R. B.) & Lee (S. B.). **Flagellates of lactiferous plants.**—*Plant Physiol.*, xviii, 4, pp. 632–655, 14 figs., 1943.

At the United States Plant Introduction Garden, Coconut Grove, Florida, in the vicinity, and on the Keys, flagellates [*R.A.M.*, iv, p. 701] were found in 12 new species of plants. Flagellates have previously been reported in the families Euphorbiaceae (28 species), Asclepiadaceae (5), Apocynaceae (5), Sapotaceae (1), Urticaceae (3), and Compositae (1). Of the commercial rubber-producing plants flagellates have been found in *Cryptostegia grandiflora*, *Funtumia elastica*, and *Taraxacum kok-saghyz*. Hundreds of specimens from other genera of laticiferous plants did not show the presence of flagellates.

Infected plants growing in their natural habitat showed no apparent symptoms of disease, the presence of the organisms being detected only by microscopic examination. Watery latex was not a criterion of infection, for flagellates were found in very viscous, creamy latex of *Funastrum clausum* growing in a dry soil. *Chamaesyce conferta* growing in cracks of bituminous pavement showed general infestation in dry weather, though after a heavy rain flagellates were found with difficulty. *C. hypericifolia* growing in coral rock in full sunlight showed high in-

festation, while large, vigorous plants growing in shade on moist glade land immediately adjacent showed no flagellates. *Poinsettia heterophylla* showed infestation of one branch tip of a plant 8 ft. high, but no flagellates in latex from another branch. The flagellates often disappear from the latex of petioles of leaves and from the peduncles of flower clusters. After some hours' rain a potted plant of *P. cyathophora*, which previously had shown many flagellates, failed to show them in any petiolar latex, though they remained in a plant whose leaves had been protected from the rain.

Latex flagellates are difficult to culture, but mass multiplication was obtained in a rich, beef-extract peptone medium injected into coco-nuts containing their natural milk and in the same medium in flasks to which fresh *Hevea* latex was added. The flagellates in *Poinsettia*, *Chamaesyce*, and *Funastrum* have a single anterior flagellum, which arises anterior to the parabasal body. In *F.*, the flagellum is very short. In *P.* and *C.* the flagella are often longer than the body. The blepharoplast and nucleus differ in the different host species in size, position, and staining density. Some nuclei are large, rounded, and distinct, while others are elongated and indistinct. In *F.* only thin, twisted, ribbon-like forms with blunt-ended bodies were seen. These same forms occurred in the other latices, but were less usual in *P.*

White (N. H.). **A spot disease of Guayule (Parthenium argentatum Gray).**—*J. Coun. sci. industr. Res. Aust.*, xvi, 4, pp. 258–260, 2 pl. (facing p. 300), 1 fig., 1943.

In November, 1942, imported guayule (*Parthenium argentatum*) seed was planted in a half-acre, well-protected plot at Canberra. Early in March, 1943, leaf-spot symptoms developed on a few plants, and from then until May the disease spread on individual plants and to those surrounding the originally infected ones, until about 20 per cent. of the area was affected. The diseased plants occurred in patches extending to about 20 ft. in diameter. The same condition was also observed in flats at Black Mountain.

The first symptom was the appearance of concentrically disposed, sunken, light brown points covering a circular area about 3 to 8 mm. in diameter, and surrounding a rather larger, darker, central lesion. The spots were spaced at intervals of about $\frac{1}{2}$ mm. Gradually the whole affected area became brown and dead; occasionally the entire leaf became involved, with resultant defoliation. The zone of defoliation extended from near ground-level to one-third of the height of the plant. Above this, the lowest leaves were black, dry, and dead, those higher up showing a few spots or none. Some plants were killed, and most remained stunted. Blackish lesions were also noted on flower stalks, mainly near the foliage. Inoculations of healthy plants with conidia from lesions gave characteristic symptoms.

The fungus was identified as a species of *Ramularia* somewhat resembling *R. bellunensis* [*R.A.M.*, xvii, p. 584]. The sporodochia-like fruit body consists of fasciculate, septate, hyaline, branched or simple conidiophores, 90 to 200 μ long, bearing chains of hyaline, cylindrical, usually uniseptate conidia, 20 to 44 by 2·1 to 5·2 (average 36·5 by 3) μ.

Two lots of seed soaked in water for 24 hours, then immersed for two hours in a 5 per cent. solution of calcium hypochlorite, washed in running water for 12 hours, and finally dried and sown, gave plants free from disease, though seed of the same lots, untreated or rubbed out only, produced diseased plants.

Martin (T. L.) & Anderson (D. A.). **Organic matter decomposition, mold flora and soil aggregation relationships.** –*Proc. Soil Sci. Soc. Amer.*, vii, pp. 215–217, 1942. [Abs. in *Chem. Abstr.*, xxxvii, 20, p. 6076, 1943.]

The changes in chemical composition accompanying the decomposition of organic

matter in the soil induce corresponding alterations in the mould population. The fungi developing during the process of disorganization differ in their capacity for the aggregation of soil particles, the order of efficiency in this respect being related to the chronology of their appearance and increasing from *Rhizopus* through *Mucor*, *Penicillium*, and *Aspergillus* to *Cladosporium* [*R.A.M.*, xxii, p. 274].

Pape (H.). **Die Herzfäule des Mohns. Eine für Deutschland neue Ölmohnkrankheit.** [Poppy heart rot. An Opium Poppy disease new to Germany.]—*Kranke Pflanze*, xx, 7–8, pp. 63–64, 6 figs., 1943.

Heart rot of the opium poppy (*Papaver somniferum*), associated with boron deficiency, has of late been observed to cause severe damage to the crop in various parts of Germany [*R.A.M.*, xxi, p. 471], where its cultivation, like that of other oil-yielding plants, is being widely extended. In the 26 stands inspected by the writer in the Kiel district the incidence of the disease mostly ranged from 10 to 20 per cent., with a minimum of 1 or 2 and a maximum of 85, while losses of 20 to 30 per cent., were not uncommon. The reaction of the soils on which the affected plants were growing was slightly acid to neutral (P_H 5·8 to 7·1). Symptoms of the disturbance, which presents a close analogy with heart rot of beet and is presumably controllable by similar measures, include stunting (often down to half the normal height); a dark purplish-brown discoloration and dying-off of the heart; distortion and crinkling of the leaves, accompanied by a partial yellowish-grey tinge and blackening of the veins; dark spots and stripes, sometimes also blisters and cracks, on the stems, whence a brownish-black latex is exuded, and in most cases, a more or less extensive blackening and disorganization of the internal stem tissues.

Drummond-Gonçalves (R.). **Ferrugem da Hortelã Pimenta.** [Mint rust.]—*Biológico*, ix, 12, pp. 383–386, 1 fig., 1943.

Mint rust (*Puccinia menthae*) has recently been observed in various districts of the State of São Paulo, this being the first authenticated report of the pathogen for Brazil. The uredospores retain their germinability for over 180 days, and under the mild winter conditions prevailing locally the rust will probably be perpetuated by means of these organs. On the other hand, the optimum temperature for uredospore development lies between 15° and 25° C., so that the diffusion of the disease is likely to be restricted during the rainy months, at which time, moreover, the resistance of the host to parasitic infection reaches a maximum. Another factor that may limit the activities of *P. menthae* in São Paulo is the prevalence of *Darluca filum* [*R.A.M.*, xxii, p. 264]. Control measures should include the annual renewal of plantings, ten minutes' immersion of the rhizomes in water heated to 45° C. before planting in furrows at least 5 cm. in depth: in cases of severe infection, the leaves should be harvested early and cut right down to the ground, a second cutting being made before the advent of the cold weather to prevent teleutospore development; after gathering the crop, all refuse should be buried or burnt to check the spread of the rust.

Cross (W. E.). **Datos adicionales sobre el 'carbón' en las distintas variedades de la Caña de Azúcar.** [Additional data on 'smut' in the different Sugar-Cane varieties.]—*Bol. Estac. exp. agríc. Tucumán* 43, 13 pp., 1943.

Further data are presented concerning sugar-cane smut [*Ustilago scitaminea*] in Tucumán, Argentine, during the season of 1942–3 (up to 25th November) [*R.A.M.*, xxiii, p. 150 and next abstracts]. Infection proceeded uniformly up to the second half of December, reaching a climax in the first week of January and continuing with diminished intensity until the middle of May, when the final count was made. The following varieties remained free from smut throughout the year: P.O.J. 2725, 2727, and 2961, and Tuc. 1149, 1238, 1296, 1590, 2605, 2611, 2613,

2622, 2645, 2651, 2657, 2680, 2683, 2701, 2704, and 2705. Slight sporadic infection occurred on Co. 290 and Tuc. 379, 1111, 1190, 1220, 1406, and 2634, while Co. 270, Kavangire, P.O.J. 2878, and Tuc. 630 sustained a somewhat heavier, but still very mild attack. On the susceptible varieties P.O.J. 36 and 213 and Tuc. 472 and 1376 the disease assumed a much more severe form than in 1941–2. Besides the varieties already enumerated, the following contracted virulent infection at the Experiment Station: Paz Posse (P.O.J. 36 purple), P.O.J. 36M, P.O.J. 36 striped, P.O.J. 161 and 234, P.W.D. 38, and Tuc. 385. Symptoms ranging from moderate to severe were observed on Tuc. 355, 362, 399, 1106, 1176, 1180, and 1331, an intermediate degree of infection was registered on Co. 508, C.P. 28/11, 28/19, 29/320, P.O.J. 1337 and 2696, Uba of Puerto Rico, and 49 Tuc. lines. Bambú de Tabandí, Co. 281, 284, and 289, C.P. 807, Oshima, P.O.J. 1507, Yon Tan San, and 24 Tuc. lines were apparently resistant, while virtual immunity was exhibited by Co. 413 and 421, C.P. 29/116, P.O.J. 2714, 2725, 2727, 2883, 2946, 2947, 'P.O.J. 2961', S.P.I. 33.243, Uba Brandes, and 240 Tuc. lines.

Studies on the heredity of the Tucumán lines showed that all descendants of Nos. 11, 27, 33, and 37 have hitherto remained entirely free from smut, while the offspring of 10, 14, 15, 22, 23, and 28 are highly resistant, whereas the progeny of 7, 8, 29, 30, 31, 32, and 34 are subject to a considerable degree of infection.

Hayward (K. J.). **El 'carbón' de la Caña y los insectos.** [Sugar-cane smut and insects.]—*Circ. Estac. agríc. Tucumán* 123, 1 p., 1943.

Three species of insects are constantly found associated with sugar-cane smut (*Ustilago scitaminea*) [see preceding abstract] viz., a species of *Phalacrus* (Phalacridae), *Brachytarsus zeae* (Anthribidiae), and *Anthicus albifasciatus* (Anthicidae). Though these insects may benefit the host by consuming smut spores, they are likely to assist in the dissemination of smut from plant to plant by the spores which adhere to their bodies. However, the risk of spread by insects is negligible in comparison with the effect of wind in plantations where the destruction of diseased material is omitted.

Lucas (G. B.). **Further studies on the deterioration of the red rot fungus in culture.** (Abstract).—*Proc. La Acad. Sci.*, vii, p. 35, 1943.

Continuing his earlier investigations [*R.A.M.*, xxi, p. 303], the author carried *Colletotrichum falcatum*, the agent of sugar-cane red rot, through 37 single-spore and 39 hyphal-tip generations on oatmeal agar with no loss of sporulation. When the cultures were allowed to age, light-coloured patch variants appeared, which on subsequent culturing produced only a few spores. Loss of sporulation by *C. falcatum* would appear to be due to the occurrence of patch variants, which tend to replace the original type and produce few or no spores.

Hirschhorn (Elisa). **Adiciones y correciones a los especies del genero 'Ustilago' en la Argentina.** [Additions and corrections to the species of the genus '*Ustilago*' in Argentina.]—*An. Soc. cient. argent.*, cxxxiii, 3, pp. 217–218, 1942.

In this summary of the results of the author's study of material collected since the publication of her previous contribution to the knowledge of the Ustilaginales of Argentina [*R.A.M.*, xviii, p. 710], it is stated, *inter alia*, that *Ustilago paspali* Speg. is separated from *U. microspora* Schroet.; and that the diagnoses of a number of species, among them *U. paraguariensis* [on *Cynodon dactylon*: ibid., xix, p. 120], are completed. In a planting of oats at Neuquén consisting of a mixture of *Avena sativa* and *A. nigra*, some 25 per cent. of the former were attacked by *U. levis* [*U. kolleri*], from which the latter at the time of writing was still free, suggesting the possibility of its utilization in the development of immune varieties by hybridization.

Teixeira de Vasconcelos (A.). **Fusarioses.**—*Rev. agron., Lisboa*, xxx, 1, pp. 19–48, 1 diag., 1942. [Portuguese.]

This is a survey of the available information on the genus *Fusarium*, among the aspects discussed being its taxonomy, economic significance, parasitism, toxicity to livestock, modes of infection, response to environmental factors, conditions predisposing and adverse to the development of fusarioses, host resistance, and measures of indirect and direct control.

Coker (W. C.) & Beers (A. H.). **The Boletaceae of North Carolina.**—viii+96 pp., 66 pl. (6 col.), 7 figs., Chapel Hill, University of North Carolina Press, 1943. $7.00.

In this work the authors describe 68 species and six varieties of *Boletus*, including three new species and four new varieties, together with four species of *Boletinus* and one of *Strobilomyces*. Twenty species are represented in colour, and almost all the remainder in half-tone photographs. There are, in addition, five plates of line drawings of spores. The study includes a description of the genus *Boletus*, with keys to the species. There is a two-page bibliography.

Preston (N. C.). **Observations on the genus Myrothecium Tode. I. The three classic species.**—*Trans. Brit. mycol. Soc.*, xxvi, 3 4, pp. 158-168, 2 pl., 5 figs., 2 graphs, 1943.

The author gives emended descriptions of the genus *Myrothecium* and its three classical species, *M. roridum*, *M. verrucaria*, and *M. inundatum*, based on a study of exsiccata and living material. *M. roridum* forms sessile, discoid, often confluent sporodochia, 0·1 to 1·5 mm. in diameter, green at first, becoming black, white-rimmed, without setae, arising from the mycelium or erumpent stroma, with a woolly margin; hyaline conidiophores once or twice branched, the main axis tapering, of three or four cells, the basal, 30 by 3 μ, and the apical, 10 by 1·5 μ, the branches uni- or bicellular, each terminating in a whorl of usually 3 to 7 phialides, which are slenderly clavate, straight, hyaline, sometimes arising below the septum of an intermediate cell forming a closely packed hymenium-like layer; and cylindrical or slightly tapering conidia with rounded ends, continuous, hyaline, becoming pale green, 5 to 9 by 1 to 2·5 μ, the spore mass being green, then jet-black and viscid.

In Britain *M. roridum* has been isolated from three hosts only, *Viola tricolor* [*R.A.M.*, xviii, p. 802], *Antirrhinum majus* [ibid., xvii, p. 590], and tomato. When cultured on various artificial media the three isolates were indistinguishable from one another, except that the fungus from *V. tricolor* usually stained maize-meal agar bright yellow. The following cultures received from the Imperial Mycological Institute are considered to be referable to *M. roridum*: one from *Hibiscus esculentus*, two from *Dolichos lablab*, and one from *Trichosanthes*, all collected by Deighton in Sierra Leone [ibid., xviii, p. 157]. Both the British and African specimens showed a very similar response to temperature: the optimum was at about 30° C., but all grew almost equally well at 20°, the African forms growing slightly more rapidly at either of these temperatures; growth was inhibited in all at 37°, but whereas the African forms remained viable for four days at this temperature and resumed growth when transferred to 23°, the British made no recovery under similar circumstances. The effect of hydrogen-ion concentration of the medium on the growth of the species was studied only on the British isolates from *V. tricolor*, which were definitely favoured by alkalinity: no growth occurred at P_H 3·4, but at P_H 4·8 the fungus grew normally, the rate of growth increasing slightly with rise of P_H from this point to a maximum of 8·2.

Stevenson (J. A.). **Fungi novi denominati. I.**—*Mycologia*, xxxv, 6, pp. 629–637, 1943.

Technical descriptions with Latin diagnoses are given of 12 hitherto undescribed

fungi, including *Clasterosporium polypodii* n.sp. on *Polypodium nanum* from Venezuela.

Fifty-fifth Annual Report of the Kentucky Agricultural Experiment Station for the year 1942.—51 pp., [1943].

In this report on plant disease work in Kentucky in 1942 [cf. *R.A.M.*, xxi, p. 516], it is stated that *B[acterium] angulatum* [*Pseudomonas angulata*] was isolated from artificially inoculated soil and naturally infected field soil throughout the winter to 21st April [ibid., xxi, p. 308]. Where cover crops were growing in artificially inoculated soil, more bacteria were isolated than from fallow soil. Roots of wheat, crimson clover [*Trifolium incarnatum*], and vetch, grown outdoors in artificially contaminated soil, carried the organism. Cover-crop roots (wheat, barley, and rye), collected during the spring of 1942 from fields where tobacco had been infected with *P. angulata* and wildfire [*P. tabacum*] in 1941, produced severe infection on tobacco leaves when the roots were washed, crushed in water, and poured over the under surface of water-soaked leaves. Tests with tobacco-bed soils while the plants were small gave no infection, but as the plants became larger *P. tabacum* was isolated from the roots of plants in five beds, *P. angulata* from those in 19, both from those in one bed, and neither from those in 22 beds. Both were obtained from shepherd's purse [*Capsella bursa-pastoris*] and quack grass [*Agropyron repens*], *P. tabacum* alone from knotweed [*Centaurea* sp.], henbit [*Lamium amplexicaule*], and quack grass, and *P. angulata* from ragweed [*Ambrosia* sp.] and various grass and weed roots. Bacterial colonies were easily found on the roots of tobacco plants from beds and from fields affected by wildfire and angular leaf spot. Heavy infection developed on tobacco leaves when the inoculum consisted of a fragment of root tissue on which the colony was present. Both diseases were repeatedly produced on inoculated leaves throughout the summer and autumn in this way, indicating that in the field tobacco roots may be the source of inoculum for sudden outbreaks in wet periods. Heavy infection of water-soaked tobacco leaves resulted from inoculated roots of wheat, oats, barley, rye, castor beans [*Ricinus communis*], soy-beans, cowpeas, vetch, lucerne, red clover [*T. pratense*], crimson clover, *Plantago*, and *Oxalis*.

The Burley tobacco variety Ky 52, obtained by back-crossing mosaic-resistant (N) *Nicotiana digluta* Burley hybrids with Ambalema type mosaic-resistant Burley has remained free from mosaic [ibid., xxii, p. 499; xxiii, p. 152] for three years, even when inoculated. It also makes rapid, vigorous growth in soil infected with black root rot [*Thielaviopsis basicola*]. It merits trial by growers.

As the N type of mosaic resistance in Ky 48—7 Burley tobacco has been criticized because inoculated plants sometimes develop systemic streak and die, a test was conducted, in which one bed of N plants was heavily inoculated with mosaic and another lightly inoculated about a week before pulling and setting. Leaf-spotting appeared in both beds, but no streak. In the first three weeks after setting 12·6 and 5·2 per cent., respectively, of the plants set from these beds died. When other plants were pulled with hands contaminated with dark, fire-cured tobacco from mosaic plants, all 91 plants set remained healthy, but when healthy plants were pulled with hands contaminated with inoculum from freshly crushed mosaic leaves, only 4 of 94 plants set remained alive three weeks after setting. The usual contamination on workers' hands while weeding or pulling can have very little effect on the stand of resistant plants, and handling even severely necrotic plants at pulling time cannot have much effect on stand. In the mosaic breeding plot, where all plants were inoculated with mosaic and were subject to reinfection throughout the summer, only two of several hundred N plants developed streak. Several years' work with N-resistant plants has furnished no evidence that this type of resistance would not control tobacco mosaic.

Beach (W. S.) & Sacco (P.). **Pathogenicity for Tobacco of some bacterial isolates antigenically similar to Bacterium tabacum.** Abs. in *Phytopathology*, xxxiii, 12, p. 1109, 1943.

The comparative pathogenicity to Pennsylvania Broad leaf tobacco of 62 cultures of bacteria selected from a series of 603, isolated by Reid *et al.* from healthy clover and tobacco and tobacco soils [*R.A.M.*, xxii, p. 80], was determined at the Pennsylvania Agricultural Experiment Station. Following heavy atomization of succulent leaves, 36 isolates, comprising some from each of the above-mentioned sources, induced the development of wildfire spots comparable to those associated with *Bacterium tabacum* [*Pseudomonas tabacum*], while the remainder gave negative results, except for a few which were capable of slight penetration of tissues subjected to water-soaking by a forced spray, and may have been strains of *Bact. angulatum* [*P. angulata*] of a low order of virulence. Weak isolates of *P. tabacum* acquired a marked enhancement of pathogenicity by seven daily passages through either of two liquid media, one consisting of mineral salts and 5 per cent. asparagin, and the other of unheated tobacco juice and 2·5 per cent. asparagin. The non-infectious isolates acquired no appreciable pathogenicity by passage through these media. The increased virulence appeared to be due to the abundance of halo-producing toxin. The harmless character of a large proportion of the wildfire isolates affords further evidence that similar agglutination reactions [loc. cit.] are not necessarily correlated with equality of virulence. Field observations as to the overwintering of *P. tabacum* in Pennsylvanian soil appear to be confirmed by these experiments.

Ware (W. M.) & Glasscock (H. H.). **Bacterial canker of Tomato.** *J. Minist. Agric.*, l, 11, pp. 499–503, 2 pl., 1 map, 1944.

During May and June, 1942, tomatoes grown in two commercial glasshouses in East Sussex were found to be affected by bacterial canker (*Corynebacterium michiganense*) [*R.A.M.*, xxiii, p. 155]. In July, 1943, outdoor tomatoes in West Sussex were observed to show marked infection. A few days later another specimen was received from a second nursery in West Sussex, followed soon after by others from Surrey and East Sussex, and by early September the disease appeared to be present in seven plantations. The worst outbreaks occurred in two Surrey plantations. In one nursery more than one quarter of a plantation of 8,000 outdoor tomato plants was severely affected; over 1,000 of these had been dug up and destroyed by mid-August. Fruit-spotting early in September further reduced the saleable crop. In another nursery in the vicinity about 20 per cent. of the plants in a half-acre plantation showed severe symptoms in mid-August, and the disease appeared to be spreading. Severe infection was also present in two other Surrey plantations, though only two or three plants were reported as being affected in the West Sussex plantations.

In four Surrey nurseries the Hundredfold variety was affected first and also most severely. The seedlings used by three of the nurseries had been raised in a single glasshouse, and the seed to produce these had been obtained from the same firm of seedsmen as the seed used by the fourth nursery. This seed was of Canadian origin, and may possibly have been infected. In the Sussex outbreaks the seed came from different sources, all, apparently, in Britain. The channels through which the disease was introduced have not been discovered. Trials of American varieties have, however, been made in the last few years in different places in the south of England, and infection may have arisen from these sources.

The first precaution to take in prevention is to use seed only from areas where infection has not occurred. Seed should not be saved from houses or plants in which infected plants have appeared. If trials are conducted with foreign seed, the seedlings should be raised in houses separate from those used for raising seedlings for the commercial crop. Soil in glasshouses should be steam-sterilized.

The Ministry of Agriculture has taken action under the Destructive Insects and Pests Acts requiring growers on whose premises the disease has occurred to destroy infected material, not to save seed from infected crops, and to take various other precautions. Growers who suspect the presence of the disease should report the matter at once.

Moore (W. D.) & Thomas (H. R.). **Some cultural practices that influence the development of Alternaria solani on Tomato seedlings.**—*Phytopathology*, xxxiii, 12, pp. 1176–1184, 1 graph, 1943.

In the course of further studies on the factors affecting the incidence of *Alternaria solani* on Marglobe seedlings in Georgia [*R.A.M.*, xxii, p. 157] and Indiana, the amount of infection was found to increase with the age of the plants, the extension of wilting periods (between picking and packing for export) from 6 to 24 hours, and the prolongation of storage at the northern destination of the seedlings up to four days before planting out. An appreciable reduction in the extent of loss or damage from the leaf blight may be effected by the avoidance of these errors.

Gottlieb (D.). **Expressed sap of Tomato plants in relation to wilt resistance.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1111, 1943.

Sap expressed from the stems of three tomato varieties retarded the growth of *Fusarium bulbigenum* var. *lycopersici* [*R.A.M.*, xxii, p. 330] in proportion to their individual resistance to the fungus, the average yields of the mycelial mats in sterile extracts from Bonny Best, Marglobe, and Pan American being 0·145, 0·110, and 0·065 gm., respectively. Comparable results were obtained when the saps were mixed with equal parts of 3 per cent. potato dextrose agar and the linear growth measured, the average dimensions of the colonies on media from the three varieties being 81, 74, and 65 mm., respectively. The inhibitory substance in the juice was stable at 100° C. for two hours, and was absorbed by activated charcoal at room temperature. Its repressive properties survived distillation at 95° under reduced pressure.

Chester (K. S.). **Physiogenic brooming in Chinese Elm.**—*Proc. Okla. Acad. Sci.*, xxiii, pp. 46–49, 1 fig., 1943.

The writer's investigations in 1942 on the etiology of a brooming disease in a 320-acre block of Chinese elms (*Ulmus pumila*) near Oklahoma City are described. The branches of the trees, which were obtained 12 years previously from a Texas nursery, bore hemispherical galls, 1 to 3 cm. in diameter, their surfaces roughened by many adventitious buds, and each producing 3 to 12 adventitious twigs, nearly half of the latter being dead. The internal tissues of the excrescences, which consisted entirely of hypertrophied phloem and cortex, were distorted but not decayed. The galls occurred exclusively at the nodes, the condition being evidently systemic, since every node on each affected branch was involved. The exudation of mucilage from the outgrowths was observed. On an inspection of the growing trees from which the galls had been removed for laboratory studies, the most conspicuous feature was found to be the production by the shortened main branches of five or six times the normal number of small lateral branches, occasioned by a die-back of the terminal twigs during the previous five years.

In view of the facts that no pathogenic organism could be demonstrated, the condition was not graft-transmissible, no evidence of spread from broomed to healthy trees was apparent, and the former recovered a year or two after transplanting to more favourable sites, the Chinese elm disease is considered to be non-contagious and of physiogenic origin. Among the contributory factors may have been the inability of the roots to penetrate the impermeable clay subsoil of the block sufficiently to develop the extensive root system required to withstand the

effects of drought, which occurred in a severe form from 1934 to 1936; defoliation by leaf-feeding insects in 1940–1; a destructive ice storm in the winter of 1939 to 1940; and an exceptionally hard frost in November, 1940, resulting in widespread injury to tree trunks throughout the south-west.

Gruenhagen (R. H.). **Life history of Hypoxylon pruinatum in relation to pathogenicity on Aspen.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1112, 1943.

Aspen stands inspected in the Lake States, where the tree is widely used for boxwood, pulpwood, and the like, and constitutes a potential source of raw cellulose for explosives and plastics, harboured 10 to 60 per cent. infection by *Hypoxylon pruinatum* [*R.A.M.*, xix, p. 505], which was found to enter exclusively through bark wounds. Inoculation tests were most successful when the fungus was inserted through an injury near the centre of a bruise. An active infection girdled a 4-in. tree in two to three years and spread 3 to 6 ft. in a vertical direction. The pathogen invaded only the cortex, cambium, and outer wood. Conidia were borne on conidiophores at the surface of the canker, as well as on raised mycelial pillar-like structures, and were abundant during the spring and early summer. From April to the end of September ascospores were forcibly expelled from perithecia in stromata protruding above the canker surface. Both conidia and ascospores were disseminated by the wind. The spread of the disease was promoted by warm, rainy weather, followed by periods of high humidity. *H. pruinatum* overwinters both in the mycelial stage and in the form of ascospores. On malt agar it grew best at 28° C. and at P_H 5 to 6.

Plakidas (A. G.). **Arborvitae blight.**—Abs. in *Phytopathology*, xxxiii, 12, p. 1117, 1943.

'Blight' or 'fire' of oriental arborvitae (*Thuja orientalis*), which has been prevalent in the southern United States for many years, especially on the Berkmann's Golden and Baker varieties, is characterized by the dying-off and brown discoloration of the leaves, small twigs, or whole branches, and often by the death of the entire tree. Similar symptoms also occur on the Italian cypress (*Cupressus sempervirens*). A species of *Cercospora* has been constantly found associated with the disease, which developed in a typical and severe form on plants inoculated with pure cultures or conidia-bearing twigs. The fungus was reisolated from the inoculated plants and found to resemble *C. sequoiae* and its var. *juniperi*, but differs from them in conidiophore length and growth rate in culture. The perithecia of a species of *Mycosphaerella* are commonly found on infected twigs, either alone or in conjunction with the conidial stage. Ascospore isolates were like those of the *Cercospora* in culture, but so far inoculations with the former have given negative results.

Tryon (H. E.). **Stem girdling of coniferous nursery stock by frost-heaved soil.**—*J. For.*, xli, 10, pp. 768–769, 1943.

Stem-girdling of young conifers by the mechanical action of frozen soil has been observed for several years past at the Forest Service Wind River Nursery, Carson, Washington, the species affected including Douglas fir (*Pseudotsuga taxifolia*), ponderosa and western white pines (*Pinus ponderosa* and *P. monticola*), Sitka spruce (*Picea sitchensis*), Port Orford white cedar (*Chamaecyparis lawsoniana*), and the Pacific silver, Shasta red, and noble firs (*Abies amabilis*, *A. magnifica* var. *shastensis*, and *A. nobilis*). The injury usually occurs in the autumn after the plants have become hardened, and during periods of alternate freezing and thawing, but has also been observed to take place before the close of the dormant stage in the spring. When only the outer bark is involved, a sloughing of the loosened portion is the sole noticeable symptom, but when the bark and cambial tissue are pushed up the stem they are pressed together in folds, leaving below a completely girdled

area, ¼ to 1 in. long. The bark above the girdled zone may remain folded or split on one side and hang loosely from its point of attachment. All the seedlings examined showed a swelling of the stem above the girdle due to an accumulation of foodstuffs, as well as an increase in girth of the entire upper portion associated with continued growth. Death usually ensues in the season following the injury.

F. Kaufert in (unpublished) work at the same nursery in 1929 described a partial or total girdling of conifer seedlings at or above soil-level caused by heat (cf. also C. Hartley in *J. agric. Res.*, xiv, pp. 595–604, 1918), but in this case the injury was accompanied by lesions, which were absent from the mechanically damaged trees. Complete girdling of young Douglas fir stems induced by high soil temperatures was also observed at a western Oregon forest nursery, but the part involved was invariably at soil-level, instead of ¼ to 1 in. above it, as in the frost-heaved soil injury.

Roth (L. F.) & Riker (A. J.). **Influence of temperature, moisture, and soil reaction on the damping-off of Red Pine seedlings by Pythium and Rhizoctonia.**— *J. agric. Res.*, xlvii, 7, pp. 273–293, 1 fig., 7 graphs, 1943.

A study of the influence of temperature, moisture, and soil reaction on damping-off of red pine (*Pinus resinosa*) seedlings in Wisconsin caused mainly by *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* [*R.A.M.*, xii, p. 158, and next abstract], carried out under controlled conditions in the greenhouse, showed that in uninoculated containers germination was poor at 12° and 15° C., good at 18° and 33°, and excellent at 21° to 30°, while subsequent seedling growth was best between 15° and 30°. *P. irregulare* killed over 90 per cent. of the seedlings at 12°, about 50 per cent. at 33°, and had intermediate effects at temperatures between these limits. *C. solani* caused damping-off in only a few seedlings at 12°, loss rising to a maximum of 58 per cent. at 24° to 30°, and declining again at 33°. The optimum temperature for the growth of both fungi in culture was 28°. At 4° *C. solani* approached a minimum, though *P. irregulare* still grew fairly well. At temperatures over 28° decline was more rapid for *P. irregulare* than for *C. solani*. Damping-off due to *P. irregulare* was at a minimum when the soil moisture content was 13 per cent. and increased to a maximum as it rose to 100 per cent.; that due to *C. solani* gradually rose from a high level at 13 per cent. soil moisture to a maximum at 68 per cent., after which it decreased to a minimum at saturation.

Air humidity had little or no effect on damping-off due to *P. irregulare*, but high air humidity increased the loss caused by the aerial mycelium of *C. solani*. In culture *P. irregulare* grew at P_H values from 3·7 to about 9, while it made best growth between P_H 5 and 8. *C. solani* grew from P_H 2·4 to about 9, growth being most rapid between about P_H 3·5 and 7·5. The optimum range for the development of red pine was from about P_H 4·7 to 6. With regard to damping-off, a broad range favourable for *P. irregulare* was found to lie between P_H 5·2 and 8·5. Below 5·2 the loss was comparatively small. There was a close relation between the rate of growth in culture and the severity of damping-off due to *P. irregulare*. The range from P_H 5·2 to 7·8 was only moderately favourable to *C. solani*, increase being rapid when acidity was stronger than P_H 5·2. Increase in damping-off by both fungi at levels over P_H 7 appeared to be connected with decline in host development. The distinct responses of the two fungi to the factors studied in the present work indicate that damping-off caused independently by *P. irregulare* and *C. solani* should be considered and treated as two diseases.

In the course of the work a method of controlling the moisture content of the top ½ in. of soil, in which damping-off fungi are most active, was devised. Cylinders of different heights containing soil were stood in water and the height of the capillary column of water regulated the moisture of the surface soil.

Roth (L. F.) & Riker (A. J.). **Seasonal development in the nursery of damping-off of Red Pine seedlings caused by Pythium and Rhizoctonia.** *J. agric. Res.*, lxvii, 11, pp. 417–431, 4 graphs, 1943.

Continuing their studies on the damping-off of red pine [*Pinus resinosa*] in Wisconsin forest nurseries caused by *Pythium irregulare* and *Rhizoctonia* [*Corticium*] *solani* [see preceding abstract], the authors made a detailed investigation of the effect on the disease of temperature, soil moisture, air humidity, and soil reaction. The experimental plots were inoculated with local strains of the two fungi, and data were taken at five- and three-day intervals throughout two seasons on equal numbers of seedlings. Seed was planted, and counts were made at regular intervals of time in order that the effects of environmental conditions might be observed on seedlings of comparable age. Only post-emergence damping-off was considered.

In 1938 damping-off increased throughout the summer as the temperature rose, the total losses for June, July, and August being, respectively, 11, 17, and 29 per cent., and the mean temperatures 67°, 71°, and 73° F. A decline near the end of July was probably conditioned by cooler weather and drier soil. For the season as a whole 54 per cent. of the total loss was caused by *P. irregulare* and 46 per cent. by *C. solani*. The two organisms, however, were not equally distinctive at all times, *C. solani* being the more important of the two during spring, and *P. irregulare* during summer. In June, July, and August, *C. solani* caused 79, 50, and 4 per cent., respectively, of the total loss. Increased temperatures favoured *P. irregulare* over *C. solani*, though some inconsistencies were noted. In the seven five-day periods when loss due to *P. irregulare* exceeded loss due to *C. solani*, the mean soil moisture was 7·2 per cent., whereas when *C. solani* predominated, it was 5·4 per cent.

In 1939, contrary to 1938, loss was greatest in spring, and declined from June onwards with declining temperature. Change in soil reaction did not influence total loss in either season. Liming reduced loss due to *C. solani* and increased that caused by *P. irregulare*. In normal plots in 1938, with P_H 5·5, the ratio of losses caused by *P. irregulare* and *C. solani* was 1 : 1 : in 1939, at P_H 7 (same area) it was 4 : 1, and in watered plots over 5 : 1. From 8th August to 7th October the ratio in normal plots with P_H 7 was approximately 2·5 : 1. When the soil reaction was altered to P_H 5·5, the ratio again became about 1 : 1.

On the whole, *P. irregulare* became most active with relatively wet, not too acid soil and high temperature, while *C. solani* was more active in a relatively acid soil with low moisture and a low temperature. A single factor, or a combination of factors, operated at times to inhibit one fungus and favour the other. In both watered and normal plots more seedlings damped off 11 to 13 days after emergence than at any other age. After 13 days in the watered plots there was a sharp decline with increasing age until 17 to 19 days. At greater ages the loss became less marked, until at 32 to 34 days it dropped to under 1 per cent. After three weeks the losses in normal and watered plots were similar.

Riker (A. J.), Kouba (T. F.), Brener (W. H.), & Byam (L. E.). **White Pine selections tested for resistance to blister rust.** *J. For.*, xli, 10, pp. 753–760, 1 fig., 1943.

Selections made in Wisconsin among native, young, cone-bearing white pine trees remained free from blister rust (*Cronartium ribicola*) after years of close proximity to *Ribes* bushes, including *R. missouriense*, *R. cynosbati*, and black currant. About 1,000 grafts and 10,000 open-pollinated seedlings from these trees, as well as commercial seedlings, were subjected to natural or artificial inoculation, or both, in the experimental nursery, with the result that a large proportion of the seedlings (up to 91 per cent.) developed cankers within a year. On the other hand, only a few of the grafts similarly treated became infected (maximum 5 per cent.), thereby affording encouraging evidence of resistance among some Wisconsin trees.

On the basis of these trials it is hoped that vegetative propagation by grafting and rooted cuttings may usefully supplement the *Ribes* eradication programme in the north-central States.

Bedwell (J. L.) & Childs (T. W.). **Susceptibility of Whitebark Pine to blister rust in the Pacific Northwest.**—*J. For.*, xli, 12, pp. 904–912, 1943.

Studies of small trees in nursery beds in British Columbia, and of larger trees in natural stands there and in Idaho, Washington, and Oregon, have shown whitebark pine (*Pinus albicaulis*) to be much more susceptible to blister rust (*Cronartium ribicola*) than western white pine (*P. monticola*). The average number of cankers per tree in the natural stands was from a little less than 3 to over 30 times as great on the former as on the latter species. In 1928, in a plot in British Columbia containing 11 whitebarks 10 to 30 ft. in height, 40 somewhat taller western white pines, and 20 bushes of *Ribes lacustre* and *R. viscosissimum*, where the rust had become established in 1917 or 1918, the number of cankers on *P. albicaulis* was 26 compared with only two on *P. monticola*. At a re-examination in 1937 six of the whitebarks had been killed by the rust and the remaining five were thought to be incapable of more than another three or four years' survival, while one of the western white pines was also dead. Hundreds of cankers were present in *P. albicaulis*, which had been killed mostly by the girdling of individual twigs and branches rather than the trunks near the crown base. This type of killing is rare, occurring only where conditions are almost ideal for infection [*R.A.M.*, xiv, pp. 66, 135] or where highly susceptible species are exposed under at least moderately favourable conditions [ibid., xviii, p. 3]. In the same year an examination was also made of 21 whitebark pines, selected at random over the area in which the experimental plot was situated, up to an altitude of 3,800 ft. above sea-level; these were found to bear an average of 31 cankers each, and it was estimated that 11 would be killed by the rust during the next 5 to 20 years. In another area, at an elevation of 4,000 to 5,000 ft., inspected in 1937, nearly all the whitebarks less than 6 ft. in height, about half those from 6 to 15 ft. and one-tenth of those over 15 ft. bore destructive cankers, and the incidence of infection was increasing rapidly.

Evidence was obtained in the Mt. Hood region of Oregon that *C. ribicola* spreads from heavily infested *Ribes* to *P. albicaulis* over distances of three to four miles.

Among the factors contributing to the susceptibility of whitebark pine to blister rust may be the longer period of needle retention as compared with western white pine, the maximum for the former in eight study areas being 5·9 growing seasons and for the latter 4·4 [ibid., xii, p. 603]. *P. albicaulis* needles, moreover, are susceptible at all ages, while those of *P. monticola* are resistant during their first year [ibid., xviii, p. 149].

Pruning may be practised as an accessory to *Ribes* eradication where the scenic value of the whitebarks justifies the additional expense. Cuts should be made 3 or 4 in. below the proximal ends of the cankers, or if these are too close to the trunk, the bark on the latter should be excised for a distance of at least 2 in. from the end of the canker.

It is thought very unlikely that *C. ribicola* will spread from its present foci on *P. albicaulis* to the sugar pine [*P. lambertiana*] stands of California to any appreciable extent: the potential risk from this source to *P. monticola* in the Rocky Mountains cannot be assessed on the basis of the information at present available.

Weber (G. F.). **A rust of Florida Pines caused by Cronartium quercuum (Berk.) Miya.**—*Proc. Fla Acad. Sci., 1940*, v, pp. 262–269, 1 diag., 1941. [Received March, 1944.]

The life-history, symptomatology, and mode of infection of *Cronartium quercuum*,

the agent of yellow pine blister rust in Florida, are fully described. Both the pine (*Pinus taeda*, *P. clausa*, *P. palustris*, and *P. australis*) and oak (about 25 species) hosts of the pathogen are widely distributed and of considerable economic importance in the State. The trunks and large branches of the pines bear spherical, oblong, or linear, gall-like swellings, by which they may be completely girdled. On oaks infection is confined to the foliage and assumes the form of yellowish blotches: on the lower surface of these are produced the yellow-orange uredosori and spores of the rust, which reinfect the oak during the summer and later give rise to the perfect (teleuto) stage, the source of inoculum for the pines. The latter are frequently attacked in the nursery, a total loss of stand ensuing when infection occurs on the main trunks of one-year-old seedlings. In a wet, grassy, open oak woodland near *P. taeda* seed trees containing thousands of one- to two-year-old 'volunteers'. 43 per cent. of the two-year-old self-sown seedlings in a measured area chosen at random were found to be dead and remaining erect, while another 21 per cent. bore stem swellings. In another area, in which only one-year-old seedlings were counted, 7 per cent. were dead and 14 per cent. infected. Aeciospore production by the pine galls is most abundant in the Gainesville district in March: infection of oaks by these organs takes place within a radius of half a mile.

The control of *C. quercuum* presents great difficulties owing to the prevalence of both hosts throughout Florida, but the annual pruning of the pine galls reduces spore production and thereby lessens the amount of inoculum for the oaks, while in planted forests diseased pines can be removed in the course of thinning operations. Such measures, however, are impracticable in dense woods or cut-over tracts. Pine seed-beds should as far as possible be located more than half a mile distant from the nearest oaks, while the repeated application of 2–4–50 Bordeaux mixture or some other standard fungicide might prove beneficial.

Discussing the taxonomy of the rust [*R.A.M.*, xviii, p. 73], concerning which the various authorities on the group are not agreed, the author proposes to apply the binomial *C. quercuum* (Berk.) Miyabe to the agent of branch galls on several species of Florida pines, notably *P. taeda*, with a wide range of southern oaks as its alternate hosts, and *C. strobilinum* Hedgc. & Hahn [ibid., xix, p. 173] to that of cone galls on *P. australis* and *P. palustris* (not *P. taeda*).

Fenton (E. W.). **Some observations on heart rot in conifers from an ecological point of view.**—*Forestry*, xvii, pp. 55–60, 1943.

A survey made in south-eastern Scotland from 1941 to 1943 showed that heart rot of spruce, Scots pine [*Pinus sylvestris*], and larch was common and widespread. *Polyporus schweinitzii* appeared to be the causal organism in Scots pine and *Fomes annosus* in spruce. Norway spruce [*Picea abies*] was the most susceptible tree. In Scots pine and larch the proportion affected was generally small, though in some localities the proportion showed rather wide fluctuations. The disease often seemed to commence in Scots pine after the age of 100 years, though it was seen in Scots pine trees 70 to 80 years old. In some woods spruce trees 50 years old or less showed a much higher incidence of heart rot than did others 70 years old or more. In most cases, however, the older spruce trees were chiefly affected. This was also the case with larch.

A definite correlation was found between heart rot in Scots pine and the presence of the moss *Leucobryum glaucum*; where the patches were large and plentiful, the heaviest damage was noted. Stagnant water and waterlogging of the soil increased heart rot, but where the water was fresh and drainage satisfactory the incidence of the disease was low. In areas where the grass *Holcus mollis* was dominant there was a definite increase in heart rot, as there was also, though to a smaller extent, where *Agrostis tenuis* was plentiful. Dunging and grazing by sheep increased heart rot, the evidence indicating that certain grassy types of vegetation, such as *Holcus*

and *Agrostis*, approach an agricultural standard of fertility near to that recognized as causing heart rot in conifers on agricultural land. Some increase in heart rot was noted where *Lastrea filix-mas* and *L. dilatata* dominated the floor of the wood.

One important finding was that in spite of the increase in heart-rot incidence in the presence of certain types of vegetation, there were always some sound trees. This suggests that some strains of conifers are resistant.

Ettlinger (L.). **Das Triebsterben der Kiefern und sein Erreger.** [The die-back of Pine shoots and its agent.]—*Ber. schweiz. bot. Ges.*, liii, pp. 469–470, 1943.

Crumenula abietina (*Brunchorstia destruens*) [*R.A.M.*, xx, p. 41] was found to be the agent of a die-back of pine (*Pinus cembra* and other species) shoots in Alpine afforestation areas. A similar, hitherto unobserved disease of larches is referred to *C. laricina* n.sp., characterized by asci measuring 66 to 107 by 5 to 9 μ, hyaline, uniseptate ascospores, 9 to 16·5 by 2·5 to 3·5 μ, and hyaline, uniseptate conidia, 10 to 21 by 2·5 to 3·5 μ. The fungus responsible for a shrivelling of spruce crowns, described by H. C. Schellenberg in 1906, was identified as *Valsa friesii* [ibid., xviii, p. 74] and its suspected connexion with *Cytospora pinastri* verified. *B. gibbosa*, hitherto reported once from America, was collected in the Lucerne district.

[Day (W. R.).] **Forest pathology.**—*Rep. Imp. For. Inst., Oxford, 1942–43*, pp. 6–7, 1943.

In this report [cf. *R.A.M.*, xxi, p. 234] it is stated that Scots pine [*Pinus sylvestris*] in Kent was attacked by *Melampsora pinitorqua* [ibid., xix, p. 376]. The outbreak appeared to be only local. An isolated example of *Peridermium cornui* [ibid., xix, p. 68] was observed on a Scots pine near Thetford, Norfolk. *Adelopus* [*Phaeocryptopus*] *gaeumanni* [ibid., xx, p. 330; xxi, p. 434; xxii, p. 162], one of the causes of needle-cast on Douglas fir, was ascertained to be generally distributed in Welsh forests. So far no serious damage has occurred, but the plantations should be watched. At Easter die-back was actually taking place in some of the European larch plantations affected by disease and was, moreover, conspicuous. Most of this die-back resulted from the girdling of side twigs or branches, girdling very often occurring at places where there was no canker. Frost appears to be the real cause of this girdling, but its full development needs to be followed under field conditions.

Leibundgut (H.) & Frick (Louise). **Eine Buchenkrankheit im schweizerischen Mittelland.** [A Beech disease in the Swiss interior.]—*Schweiz. Z. Forstw.*, xciv, 10, pp. 297–306, 2 pl., 2 figs., 1 graph, 1943.

A die-back of beeches (mostly dominant and co-dominant, 60- to 120-year-old trees), first observed at Winterthur, Zürich, in the summer of 1940 and subsequently spreading to other localities, is attributed in the first place to the exceptionally severe winter of 1939 to 1940, when the mean January temperatures fell to −4° to −5·5° C. below normal [cf. next abstracts]. The affected trees bore reddish stripes, consisting of the perithecia of *Nectria coccinea* [*R.A.M.*, xxi, p. 185] and usually running vertically along one side of the trunk. The fungus was isolated on malt agar (2 : 1·5 per cent.) on which its optimum and maximum temperatures were determined as between 18° and 24° and 33°, respectively; the minimum could not be ascertained, since cultures transferred after four weeks at −3° to the optimum rapidly produced normal colonies, indicating that the fungus would be able to survive under natural conditions. The mean ascospore dimensions of the Winterthur isolates in pure culture were 11·8±1·3 by 5·1±0·5 μ, and of the macroconidia 25·7±5·6 to 58·5±3·8 by 4·9±0·7 μ; the majority of the latter organs had only four cells instead of the six reported by Wollenweber [ibid., x, p. 626]. Inoculation experiments with *N. coccinea* were successful only through

injuries, and in no case did the spread of infection exceed 6 cm. from the site of entry or involve the sound tissues. The fungus is therefore to be regarded only as a contributory cause of the die-back. Sun scorch may also have been implicated, since most of the affected trees had a dark-coloured (greenish-brown to black) cortex and were consequently subject to abrupt daily fluctuations of temperature, and moreover, the damage occurred principally on the sides of the trunks facing south and south-west.

Larsen (P.). **Die Bedeutung der Winterkälte für die Kernbildung der Buche.** [The significance of winter cold in relation to heart formation in the Beech.]—*Schweiz. Z. Forstw.*, xciv, 9, pp. 265–272, 6 figs., 1943.

'Red heart' formation occurred extensively among beeches [*R.A.M.*, vii, p. 691 and next abstract] in Danish forests in 1943, phenomenal features of the condition including the suddenness of its appearance, the exceptional involvement of young (40- to 60-year-old) trees, and the peculiar colour of the wood, in some cases darker and in others greyer than usual. In this connexion the writer summarizes previous observations by himself and other workers on the etiology of 'red heart', which he regards as a physiogenic disorder, fungal intervention being of secondary importance. The remarkable outbreak of the trouble in Denmark is attributed to the abnormally severe winter of 1941–2, during which (in January) the temperature fell to −30° C. in many places.

Knuchel (H.). **Ergebnisse eines Versuches mit nicht imprägnierten und imprägnierten Buchenschwellen verschiedener Fällzeit.** [Results of an experiment with unimpregnated and impregnated Beech sleepers felled at different times.]—*Schweiz. Z. Forstw.*, xciv, 3, pp. 83–88, 6 figs., 1943.

On 10th October, 1941, three beechwood sleepers, buried seven years previously at a depth of 25 cm. in meadow soil after impregnation with coal tar by the Rüping process at the rate of 178 to 180 kg. per cu. m., were found to be in perfect condition. In the case of the 25 untreated sleepers excavated at the same time after an identical period of burial, the majority were almost or completely decayed. A decisive influence of the season of felling was not observed [*R.A.M.*, x, p. 146]. 'Red heart' [see preceding abstract] did not prevent, though it may slightly delay, the rotting of untreated wood, and in impregnated sleepers such heartwood, which does not absorb coal tar, constitutes the zone of incipient disorganization. Sleepers stacked at the base of the pile and thus 'asphyxiated' by proximity to the damp ground before burial were badly decayed, as also were those with extensive fissures.

Newins (H. S.). **Chemical seasoning of lumber.**—*Proc. Fla Acad. Sci., 1940*, v, pp. 85–95, 2 graphs, 1941. [Received March, 1944.]

In connexion with an account of experiments in the chemical seasoning of tidewater red cypress (including *Taxodium distichum* and *T. ascendens*) in Florida, mention is made of the promising results obtained with crystal urea, which has been found to confer resistance to wood-destroying fungi at concentrations as low as 0·2 per cent. [*R.A.M.*, xxiii, p. 159.]

Eades (H. W.). **Investigation of brown streak in Western Hemlock used for aircraft purposes.**—*B.C. Lumberm.*, xxvii, 11, pp. 50, 52, 1943.

The writer made an examination of a number of western hemlock [*Tsuga heterophylla*] flitches 4 ft. in length, originating in different parts of British Columbia, to determine the cause of the defect known as 'brown streak', 'water-soak', 'water-core', 'wetwood', 'glassy-wood', and (quite erroneously) 'mineral stain' [cf. *R.A.M.*, xxii, p. 184]. The streaks involved from 3 to 14 growth rings, each

of which contained a high proportion of late wood, and were uniformly water-soaked. Another form of dark streak, not observed in the present lot of material, connotes the incipient stage of fungal infection, e.g., by *Ganoderma oregonense* [ibid., xxiii, p. 124]. Dark-streaked wood should not be used for aircraft construction, since weakening factors are likely to be present, whatever form the defect assumes.

Other blemishes common in western hemlock are 'white streak' and 'black streak', also known as 'black check' or 'black seam'. 'White streak' appears on freshly surfaced boards as finely etched, longitudinal lines, up to several inches in length but no wider than the scratch of a pin point or thumb nail. The white ingredients of the cell lumina consist of resins or fats which are readily dissolved in glycerine, xylol, and other solvents. The wood is not in the least weakened either by 'white streak' or 'black streak', which is usually due to insect attack on the living tree.

Kimmey (J. W.) & Furniss (R. L.). **Deterioration of fire-killed Douglas Fir.** – *Tech. Bull. U.S. Dep. Agric.* 851, 61 pp., 8 figs., 3 diags., 8 graphs, 1 map, 1943.

Fungi and insects were found to be the chief agents of deterioration in fire-killed Douglas fir (*Pseudotsuga taxifolia*) in a six-year investigation of 602 trees in 63 representative areas of western Oregon and Washington. Since the two groups of organisms were usually closely associated and often interdependent, their effects were considered primarily in combination.

Wood stain (*Ceratostomella* spp.) was of considerable importance in relation to the loss of sapwood, but only during the first three years after fire. The wood-rotting fungi fell into two groups, of which one caused decay in the sapwood only and the other in both sap- and heartwood. *Polyporus* [*Polystictus*] *abietinus* was the principal species implicated in the former type of damage, being responsible for over 50 per cent. sapwood decay, and *Fomes pinicola* in the latter: this fungus induced nearly as much rot in the sapwood as *P. abietinus* and over 75 per cent. in the heartwood. Two other species causing considerable decay both in sap- and heartwood were *F. officinalis* and *Lenzites sepiaria*, while *Polyporus volvatus* and *Stereum* spp. were very injurious to the sapwood only.

Fungal and insect deterioration in fire-killed Douglas fir starts immediately below the bark and proceeds fairly uniformly from the periphery to the centre of the bole. So rapid is the process in the sapwood that it is usually unsaleable three years after a fire, the heartwood disintegrating more slowly. Trees of the young (12 to 60 in. diameter at breast height), intermediate (22 to 74 in.), and old (27 to 104 in.) growth types deteriorated in 3 to 4, 10 to 15, and 15 to 20 years, respectively; in the last-named disorganization was ordinarily incomplete until 60 years or more after death. Rates of deterioration appear to be generally similar in fire-killed Douglas fir of the Coast and Cascade forest types, and in felled and standing trees. No doubt such factors as rainfall, slope, exposure, and elevation exert an effect on the rate of deterioration, but they were so much obscured by the influence of the character of the wood, growth ring width (wide rings accelerating decay), and so forth, that their individual contributions to the disorganization of the timber could not be assessed within the limits of these studies.

Dale (W. T.). **Preliminary studies of the plant viruses of Trinidad.**—*Trop. Agriculture, Trin.*, xx, 12, pp. 228–235, 1943.

Cowpea mosaic [*R.A.M.*, xxi, p. 514] spread rapidly in certain crops during 1942, but mosaic of woolly pyral (*Phaseolus mungo*) due to the same virus was even less common in 1942 than in 1929. Soy-beans also appeared to be attacked by common cowpea mosaic, and when experimentally inoculated with the virus very

young seedlings were seriously affected. Sunn hemp (*Crotalaria juncea*) showing mosaic symptoms proved to be infected by cowpea mosaic virus. Lima beans (*P. lunatus*) were artificially infected with cowpea mosaic, though the percentage of successes was low (40 per cent.). The pure white Carolina Lima and black mottled varieties appeared to be equally susceptible. Pigeon pea seedlings were infected in the greenhouse. Over 800 seedlings of the 'gub-gub' variety of cowpeas, raised from the seed of plants infected when young, showed no sign of mosaic, though grown until the expansion of the second compound leaf. A preliminary test indicated that *Ceratoma ruficornis* may be a vector.

Common bean mosaic is also prevalent in Trinidad, producing symptoms resembling those found in the United States, whence much bean seed is imported. Most seed samples of bush beans in Trinidad give rise to a small percentage of mosaic plants. Seed transmission does not seem to occur often when the parent plant becomes infected after flowering, and the percentage is much lower when infection occurs during the growing season than when the plants have been diseased throughout the season.

The tobacco mosaic found in Trinidad is due to a typical strain of *Nicotiana* virus 1 and the same virus causes a mosaic of *Capsicum annuum* and mild mosaic in tomato.

In Trinidad small loss from breaking and crumbling of the leaf in curing results when tobacco is infected with the mosaic virus and the check to growth appears to be slight compared with the effects of waterlogging. The loss caused to tomatoes by mild mosaic is negligible. The virus causes serious losses in peppers, but these are grown only on a minor scale.

Warne (L. G. G.). **An outbreak of club-root traceable to a seed-borne infection.**—*J. R. hort. Soc.*, lxix, 2, pp. 45–47, 1944.

The information in this paper has been noticed from another source [*R.A.M.*, xxii, p. 52].

Zaumeyer (W. J.) & Harter (L. L.). **Two new virus diseases of Beans.**—*J. agric. Res.*, lxvii, 8, pp. 305–328, 3 figs., 1943.

This paper describes two new closely related viruses of bean (*Phaseolus*): bean mosaic virus 4 (southern bean mosaic virus 1) and bean mosaic virus 4A (southern bean mosaic virus 2). The exact distribution of these viruses is unknown, but bean mosaic virus 4 occurs in Louisiana and 4A in California, Colorado, Idaho, and Maryland.

The local lesions produced by virus 4 on Ideal Market are generally almost circular, brownish-red, and they often have light centres. They vary from 1 to 3 mm. in diameter. On most varieties they are rather diffuse or spreading. When the virus is concentrated, they may be so numerous as to coalesce, often causing the leaf to die and drop off. When they are located near the veins, the tissue may become necrotic for a distance of 1·5 to 3 cm. from the site of infection. The systemic or mottled symptoms occur only on plants not showing local lesions. The first sign of infection is a mild mottle of the trifoliate leaves, which later becomes intense. Veinbanding is common, the interveinal tissue being a lighter green than the tissue adjacent to the veins. The leaves may be puckered and blistered. Very mild symptoms are produced on Stringless Green Refugee and the mosaic resistant Refugee varieties. On some varieties vein necrosis, which may cause the leaves to drop off, occurs on the young trifoliate leaves. Reduction in leaf size and malformation occur in highly susceptible varieties. Pod symptoms appear as dark green, irregular, water-soaked, blotched areas in green-podded beans, and as greenish-yellow areas on wax-podded types. Infected pods of susceptible varieties are malformed, of subnormal length, and often curled at the end.

The local lesions produced by virus 4A resemble those caused by virus 4, but have more distinct edges. The systemic symptoms are less severe than those due to virus 4 in the early stages but are more severe in the later ones.

Of 80 bean varieties or strains tested, none was fully resistant to either virus. Twenty-four varieties were homozygous for susceptibility to the local lesion infection of virus 4, 8 were heterozygous, and 48 were resistant. The resistant varieties were susceptible to systemic infection, and the heterozygous were resistant. Thirty varieties were susceptible to the local lesion infection of virus 4A, and 6 of these were heterozygous; 50 varieties were resistant, all being susceptible to systemic infection. *P. lunatus* and closely related hybrids between *P. lunatus* and *P. lunatus* var. *macrocarpus* were susceptible to local infection by both viruses, whereas the Fordhook types were completely resistant. The Virginia variety of soy-bean was the only other susceptible to both viruses found among 31 species, representing 20 genera in five families.

Local lesions were produced by both viruses at temperatures ranging from 16° to 27° C. They appeared most rapidly at 27°. The systemic symptoms of virus 4 appeared in 8 days at 18° to 27°, and were most severe after 20 days at 18°.

Both viruses were isolated from seed in the milk and dough stage and from freshly ripened seeds, but 4A alone was isolated from seed stored in the laboratory for seven months. About 5 per cent. of such seed produced diseased plants. Both viruses were obtained from all parts of the systemically infected green plant.

The viruses were inactivated between 90° and 95°, were infectious at 1 to 500,000 dilution, and resisted ageing *in vitro* at 18° for 32 weeks. Virus 4 was infectious after 30 minutes' treatment with 95 per cent. alcohol; it was inactivated by a 1 to 100 nitric acid dilution in one test, but not by a 1 to 50 dilution in another. It was not destroyed by a 1 to 100 dilution of 37 per cent. formaldehyde for 30 minutes, and was not inactivated by 30 minutes' treatment in a 5 per cent. solution of sodium chloride. Both viruses were separated from a mixture of bean viruses 1 and 2 by heating above 60° for 10 minutes or diluting the extract above 1 to 2,000.

Zaumeyer (W. J.) & Harter (L. L.). **Inheritance of symptom expression of Bean mosaic virus 4.**—*J. agric. Res.*, xlvii, 7, pp. 295–300, 1 fig., 1943.

Investigation of the inheritance of the symptom expression of bean mosaic virus 4 (southern bean mosaic virus 1) [see preceding abstract] showed that it is governed by a single allelomorphic pair of Mendelian factors. Plants carrying the dominant allelomorph are susceptible to local lesions, while the homozygous recessive plants are susceptible to systemic infection, with resultant leaf-mottling, stunting, and loss of yield. Varieties possessing the dominant gene for virus localization are regarded as possessing commercial resistance and are being used in breeding work.

Reid (W. D.). **Resistance of beans against bacterial-wilt, anthracnose, and Bean-mosaic.**—*N.Z. J. Agric.*, lxvii, 6, pp. 411–412, 1943.

A brief, popular account is given of the symptoms and control of bacterial wilt of beans [*Pseudomonas medicaginis*: *R.A.M.*, xix, p. 644], bean anthracnose [*Colletotrichum lindemuthianum*], and bean mosaic. All these are present in New Zealand, but the last-named is not of major importance in crop production. Under New Zealand conditions it has not been found practicable to grow bean seed in areas where bacterial wilt does not occur. Hot water treatment and treatments with mercurial dusts have not proved satisfactory. Roguing is suitable for small growers, but spraying has not given good control of bean diseases. During the last six years 40 bean varieties have been tested at Auckland and periodically at Palmerston North for resistance to these diseases. In these trials all runner varieties were resistant to bacterial wilt, anthracnose, and mosaic; Burnley Selections of Canadian Wonder and Dun were highly resistant to bacterial wilt and

mosaic, but the former was susceptible to anthracnose; while Black Prince, Blue Pod, Woods Centenary, Dun, and Zulu King were moderately resistant to all three diseases. There is no guarantee at present that commercial lines of seed are disease-free, and in areas where disease is prevalent, resistant varieties should be sown. Small growers can use either disease-free seed or resistant varieties.

Straib (W.). **Untersuchungen zur Biologie und Bekämpfung des Bohnenrostes Uromyces phaseoli (Pers.) Wint.** [Investigations on the biology and control of the Bean rust *Uromyces phaseoli* (Pers.) Wint.]—*Gartenbauwiss.*, xvii, pp. 397–445, 1943. [Abs. in *Chem. Zbl.*, cxiv (ii), 18, p. 1662, 1943.]

All German bean varieties have been found susceptible to rust (*Uromyces phaseoli*) [*U. appendiculatus*], the control of which should be based on the collection and destruction by burning *in situ* of fallen leaves; disinfection of supporting poles with 0·1 per cent. formalin; and repeated prophylactic applications of Bordeaux mixture or other standard fungicides, sulphur dusting being possibly also feasible in regions with a low summer rainfall.

Ellis (D. E.). **Soil treatments with sodium nitrite for controlling damping-off and root knot.**—Abs. in *Phytopathology*, xxxiii, 12, pp. 1110–1111, 1943.

Damping-off of lettuce (*Rhizoctonia*) [*Corticium solani*] was effectively combated in greenhouse and seed-bed tests in 1942 and 1943 by the application to the soil of sodium nitrite, of which 4 and 8 oz. per sq. yd., incorporated into artificially infested soils four weeks before sowing, reduced the post-emergence phase of the disease by 71 and 95 per cent., respectively. At the higher dosage the compound caused a slight reduction in the stand, but gave better control than chloropicrin, formaldehyde, or urea.

Mader (E. O.). **Some factors inhibiting the fructification and production of the cultivated Mushroom, Agaricus campestris L.**—*Phytopathology*, xxxiii, 12, pp. 1134–1145, 1943.

A study of the conditions relating to mushroom (*Agaricus* [*Psalliota*] *campestris*) fructification and production, conducted in part in a limestone mine at West Winfield, Pennsylvania, and in part at the mushroom plant of Yoder Bros., Barberton, Ohio, revealed accumulations of noxious volatile substances, which in the mine tended to be more abundant in the inside than in the outside rooms. These differences were experimentally shown to be associated with the lack in the inner chambers of the natural ventilation on which air exchange in the mine depends. The sealing-up of mine rooms or experimental chambers, by permitting the concentration of the deleterious exhalations, resulted in the complete cessation of fructification. Sporophores exposed to these conditions either developed into fruit bodies of gigantic dimensions and abnormal shape, or grew only at the base of the stipe after the manner of an onion.

There was no macroscopic difference between the mycelium of mushrooms grown in the presence or absence of the volatile substances, which proved amenable to elimination by washing the atmosphere with alkaline potassium permanganate solutions, mineral oil, or activated charcoal, indicating that they probably belong to the class of non-saturated hydrocarbons, though their exact nature is unknown. The substances in question are assumed to be metabolic products either of the mushrooms themselves, or of the microflora inhabiting the growing media.

Osterwalder (A.). **Von teilweisen Lahmstieler-Trauben.** [On Grapes with partial pedicel lameness.]—*Schweiz. Z. Obst- u. Weinb.*, lii, 26, pp. 635–638, 1 diag., 1943.

'Pedicel lameness' in grapes is due to several causes. Grey mould (*Botrytis*)

[*cinerea*], for instance, frequently spreads from the rotting fruits to their stalks and thence to the main pedicel, ultimately cutting off the water supply so that the grapes become flaccid or 'lame', the heavier ones tending to break off at the soft, decayed site of infection, which is often surrounded by a grey down, consisting of the hyphae and spores of the fungus. This form of the trouble may be combated by the addition to the last *Peronospora* [*Plasmopara viticola*] spray of 200 gm. cotton oil soft soap (Maag, Dielsdorf) per 100 l. Bordeaux mixture.

The agent of white rot (*Coniothyrium*) [*diplodiella*] may also cause 'pedicel lameness' by spreading from the stalks of the bleached, roughened, insecurely attached fruits to the main pedicel.

A third form of 'pedicel lameness' in hybrid bearers, though associated with the presence in the tissues of various fungi, including *Gloeosporium*, *Fusarium*, and *Phoma* spp., is attributed to meteorological factors, especially high temperature.

Scott (L. E.). **Boron nutrition of the Grape.**—*Soil Sci.*, lvii, 1, pp. 55–65, 1944.

In an experimental vineyard comprising 50 vine varieties on a deep phase of Norfolk sand near Columbia, South Carolina, foliar symptoms suggestive of boron deficiency were observed in June, 1939, when the plants were five to nine years old. The leaves bore a well-defined pattern, with chlorotic areas towards the margin and between the veins, and their surfaces were abnormally rugose, with raised interveinal zones which induced a cupping of the under sides. Blossom-clusters were formed, but very few fruits were set, the grape yield also being greatly reduced on some vines showing little external evidence of boron deficiency. The Armalaga, Catawba, and some other varieties exhibited the phenomenon known as 'millerandage' consisting in the setting of parthenocarpic or seedless fruits. The application of borax to the soil at the rate of 10 lb. per acre corrected the deficiency symptoms and resulted in the production of heavy fruit crops, this improvement in the health of the vines being accompanied by an increase in the boron content of the foliage: in the Lenoir variety, for instance (in which the stems were also analysed), the leaves below, adjacent to, and above the clusters, the clusters and the stems below, adjacent to, and above the clusters of the treated plants contained 53, 47·3, 39, 38·6, 31·9, 27·6, and 33·5 p.p.m. boron, respectively, while the corresponding figures for the untreated were 40·3, 36, 30, 34·6, 25·2, 17·5, and 32, respectively. Varietal differences in response to boron deficiency were very noticeable. Thus, Ontario, Cayman, Armalaga, Lomanto, Seneca, and Genara were an almost total failure, Catawba, Bailey, Lenoir, Concord, Extra, Herbat, and Niagara belonged to the moderately affected group, while Champion, Portland, Fredonia, R. W. Mumson and Isabella showed few or no foliar symptoms, though there may have been a reduction of yield in some instances. The borax content of the vines was at a minimum in the early part of the growing season, and the deficiency symptoms seldom developed in the later growth.

Wallace (Maud M.). **Sclerotinia disease of Beans and other crops.**—*E. Afr. agric. J.*, ix, 3, pp. 171–172, 1944.

In June, 1942, French beans on a farm at Mondul, Northern Province, Tanganyika Territory, were found to be infected by *Sclerotinia sclerotiorum*. Though a first record for the Colony there is little doubt that the fungus had been present a number of years. Immediate steps were taken to destroy the affected material. In June, 1943, the disease occurred in many bean fields and on other plants at Machame, on Kilimanjaro, and it was also noted on beans at Oldeani. A field of sunflowers at Machame sustained a loss, due to infection by the fungus, estimated at from 30 to 40 per cent. of the crop. Tomato plants growing wild at Machame were also attacked. Potatoes showed slight stem infection. Dahlias,

Tropaeolum, and *Eschscholtzia* were lightly affected at Machame. The fungus was first observed in Kenya in 1941, where Nattrass states it attacked pyrethrum [*Chrysanthemum cinerariifolium*] and other crops.

The symptoms of the disease are described. Infected material should be dried in heaps and then burned. In areas where infection is endemic the chief preventive measure consists in the avoidance of too close planting of susceptible crops, and of interplanting with other crops. Weeds should be kept down and adequate drainage provided. It may be advisable to sow resistant crops, such as cereals or perennials. Deep cultivation results in the burial of many sclerotia. In a season favourable to the disease successful control is not to be expected.

Leach (J. G.) & Clulo (Genevieve). **Association between Nematospora phaseoli and the green stinkbug.**—*Phytopathology*, xxxiii, 12, pp. 1209–1211, 1943.

Yeast spot (*Nematospora phaseoli*) [*R.A.M.*, ii, p. 194] of Lima beans [*Phaseolus lunatus*] is common in south-eastern Virginia, but has seldom been observed in West Virginia, where a fairly extensive survey carried out in 1941 also failed to reveal its presence notwithstanding the prevalence of the supposed insect vector, *Nezara hilaris*. The fungus was, however, readily isolated from the surface of insects collected on spotted plants in south-eastern Virginia by S. A. Wingard, though cultures from the aseptically dissected internal organs were negative. Since the food channel of adult stinkbugs rarely exceeds 12 μ in diameter, and the salivary channel is several μ smaller, while the majority of mature cells of *Nematospora phaseoli* range from 10 to 20 μ in diameter, the possibility of internal biological transmission through this agency appears remote. From these observations it may be inferred that the conveyance of the fungus from diseased to healthy plants by *Nezara hilaris* is entirely external and mechanical, the insects presumably acquiring the inoculum during the spring. The natural host range of *Nematospora phaseoli* requires further investigation, preferably in milder regions where it is more abundant than in West Virginia. According to Underhill (*Bull. Va agric. Exp. Sta.* 294, 1934), the stinkbug prefers certain weeds to *P. lunatus*, and in this case the elimination of the former might offer a practical means of control.

Richards (B. L.) & Burkholder (W. H.). **A new mosaic disease of Beans.**—*Phytopathology*, xxxiii, 12, pp. 1215–1216, 1943.

In 1939 Michelite pea beans near Batavia, New York, were so heavily infected by a disease apparently identical with mosaic that harvesting was impracticable. Since the variety in question had previously been reported to be resistant to the virus (*Spec. Bull. Mich. agric. Exp. Sta.* 295, 1938), this new development occasioned some surprise. Of recent years, moreover, many complaints have been received from growers concerning the increasing susceptibility to mosaic of the normally immune Robust variety. In 1942 tests with an isolate of the virus from a plant grown in New York State on a number of samples of Robust and Michelite showed these two varieties to be fully susceptible to inoculum from this source, whereas in subsequent experiments with three strains from New York, and one each from California, Idaho, and the Canal Zone, they were attacked only by two from the first-named locality. It is evident from these data that the bean mosaic virus comprises two strains or entities, both seed-transmissible and producing virtually identical symptoms. Further trials showed the Red Kidney and Bountiful varieties to be susceptible to both; Norida, Red Mexican 3, and Great Northern, as well as Michelite and Robust, susceptible to the 'new' but not to the 'old' strain; and Great Northern 1 and 59, Ashley's and Cooper's Wax, and Refugee immune from both. Hybridization experiments aiming at the production of an immune white bean are in progress.

DOYER (L[UCIE] C.). **De beteekenis van het zaad als overbrenger van ziekten en plagen in groentegewassen.** [The importance of the seed as a conveyor of vegetable diseases and pests.]—*Tijdschr. PlZiekt.*, xlvii, pp. 14–24, 1941. [Abs. in *Zbl. Bakt.*, Abt. 2, cvi, 1–4, pp. 76–77, 1943].

The following fungal pathogens of vegetables have been found to be carried over in the seed: *Ascochyta pisi* and *Mycosphaerella pinodes* on peas, *Colletotrichum lindemuthianum* and *Macrosporium commune* [*Pleospora herbarum*] on beans, *Peronospora spinaciae* [*P. effusa*], *Phoma* sp., and *Fusarium* sp. on spinach, *Botrytis allii* and *M. parasiticum* [*Pleospora herbarum*] on onions, *Septoria apii* on celery, *S. petroselini* on parsley, and various *Alternaria* spp. on cabbage. Information concerning the incidence of infection and appropriate control measures is given in most cases.

PRESTON (N. C.). **Club root disease.**—*Gdnrs' Chron.*, Ser. 3, cxv, 2987, p. 128, 2 figs. (1 on p. 129), 1944.

Excellent control of club root [*Plasmodiophora brassicae*] in Brussels sprouts was secured in Shropshire in 1943 by the immersion of the seedling roots in a paste consisting of 1½ lb. 4 per cent. calomel [mercurous chloride] dust in 11 fluid oz. water immediately before planting out on 22nd June in a heavily infested plot that had been under *Brassicae* for the past 15 years. Two pickings were made, one on 19th November and the second on 5th January, 1944: at the former the treated and untreated plants yielded 44 and 7 lb., respectively, of marketable sprouts, the corresponding figures for the latter being 25 and 5 lb., respectively. On lifting the plants after the second picking, 43 of the treated and 80 of the untreated were found to be severely clubbed, 57 of the latter being almost completely rotted, while moderate to very light infection was observed on 52 and 7, respectively, in the two classes. In general, 1 lb. of the dust should suffice for the treatment of about 100 plants.

HADORN (C.). **Eine Rotbrenner-Epidemie in den Reben der Bündner Herrschaft.** [A 'rotbrenner' epidemic among the Vines of the Canton of Grisons.]—*Schweiz. Z. Obst.- u. Weinb.*, lii, 25, pp. 616–626, 1 fig., 1 graph, 1943.

A severe epidemic of 'rotbrenner' (*Pseudopeziza tracheiphila*) in the Canton of Grisons in 1943 was at first attributed by vintners to the use of the red Sandoz copper spray, necessitated by the recent order that 40 per cent. of the total Swiss copper consumption for agricultural purposes shall be taken in this form. The weather in the spring of 1943, however, was highly conducive to the epidemic development of the pathogen, the long dry spell from 10th April to 25th May having been followed by showers which permitted abundant apothecial production in the rotting leaves, and subsequently by a wet period from 7th to 18th June, when these organs ripened and liberated a profusion of ascospores for mass infections. The development of the fungus was further promoted by the check to the growth of the host coinciding with inclement weather in June, succeeded by another drought.

In view of the abnormal climatic conditions, only the most efficient spraying campaign could have afforded adequate protection during the protracted critical period for infection. The first treatment should have been given from 20th to 24th May, followed by a second from 30th May to 6th June. The latter was omitted by many growers. The Sandoz copper spray at 0·3 per cent. is considered adequate for the control of *P. tracheiphila*, though a somewhat superior, and notably a more prolonged effect is exerted by 1·5 to 2 per cent. Bordeaux. A 'rotbrenner' epidemic may be anticipated when a relatively dry winter with little snow is followed by a drought in April or May, and in such seasons a precautionary treatment should be given about 20th May, ten days or so before the first regular downy mildew application, and repeated at 10- to 14-day intervals.